SEPTEMBER, 1940

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In This Issue
TWENTY YEARS OF AIRLINE PROGRESS

AVIATION

CHIG STATE ARY SE 1940

The Oldest American Aeronautical Magazine

Dependable Engines
FOR FIFTEEN YEARS

For fifteen years Pratt & Whitney has been building engines for America's flying forces. The little group of twenty-five employees who built the first Wasp has now become an army of more than 10,000. Plant facilities have grown from a small warehouse to a mighty factory embracing a million and a quarter square feet. And steadily, throughout the years, an ever-increasing stream of power plants has gone out to the Army, the Navy and the air lines — each adding its share to the significance of a time-honored slogan: *Pratt & Whitney, Dependable Engines.*

PRATT & WHITNEY AIRCRAFT
One of the three divisions of
UNITED AIRCRAFT CORPORATION
EAST HARTFORD, CONNECTICUT

PROFESSOR WING'S PILOT PUZZLERS

1. **What is B.M.E.P.?**
2. **What is the approximate falling off in horsepower of an unsupercharged aircraft engine at 5,000, 10,000 and 20,000 feet of altitude above sea level?**
3. **Will aviation gasoline freeze?**
4. **What are the approximate weights of aviation gasoline and aircraft oil?**

THERE'S NO QUESTION in the mind of the experienced pilot about his need for a *balanced* gasoline. He must have quick throttle response—but he also needs economic warm-up and a wide cruising range.

Shell—first to produce 100-octane fuel commercially—offers private and commercial flyers a gasoline that is *balanced*. With Shell Aviation Gasoline in your tank, you're sure of quick starting, instant response to the throttle during take-off and climb, *plus* low fuel consumption.

Call on Shell for the answer to your fuel or lubrication problems. Just call or write Shell Aviation Department, 50 West 50th St., New York City; Shell Building, San Francisco; Shell Building, St. Louis.

ANSWERS

1 "B.M.E.P." stands for "brake mean effective pressure." It might also be called the "average pressure," and is used in speaking of the useful pressure developed in the cylinder of an aircraft engine.

In actual test work, the B.M.E.P. is calculated from the bore, stroke, number of cylinders, revolutions per minute and brake horsepower developed.

2 In unsupercharged engines, there is a progressive decrease in horsepower output at altitude owing to the fact that the air becomes less dense and thus a given quantity of air will contain less oxygen, the necessary component of combustion.

At constant revolutions per minute, the horsepower developed by an unsupercharged engine at 5,000 feet will be approximately 82% of the sea-level horsepower; at 10,000 feet approximately 66% of the sea-level horsepower; while at 20,000 feet only about 39% of the sea-level horsepower will be developed.

3 Yes. However, the temperature at which it freezes varies with the particular gasoline. Most aviation-gasoline specifications state that the freezing point shall not be above 76° F. below zero.

4 Aviation gasoline sold in this country weighs approximately six pounds per gallon, while that sold abroad weighs approximately six and one-half pounds per gallon. Aircraft oil weighs approximately seven and one-half pounds per gallon.

NOTE—The Department of Commerce uses six pounds per gallon for gasoline and seven and one-half pounds per gallon for oil in assigning payload allowances on aircraft licenses.

SHELL

AVIATION PRODUCTS

Aviation

ESTABLISHED 1916

OLDEST AMERICAN AERONAUTICAL MAGAZINE

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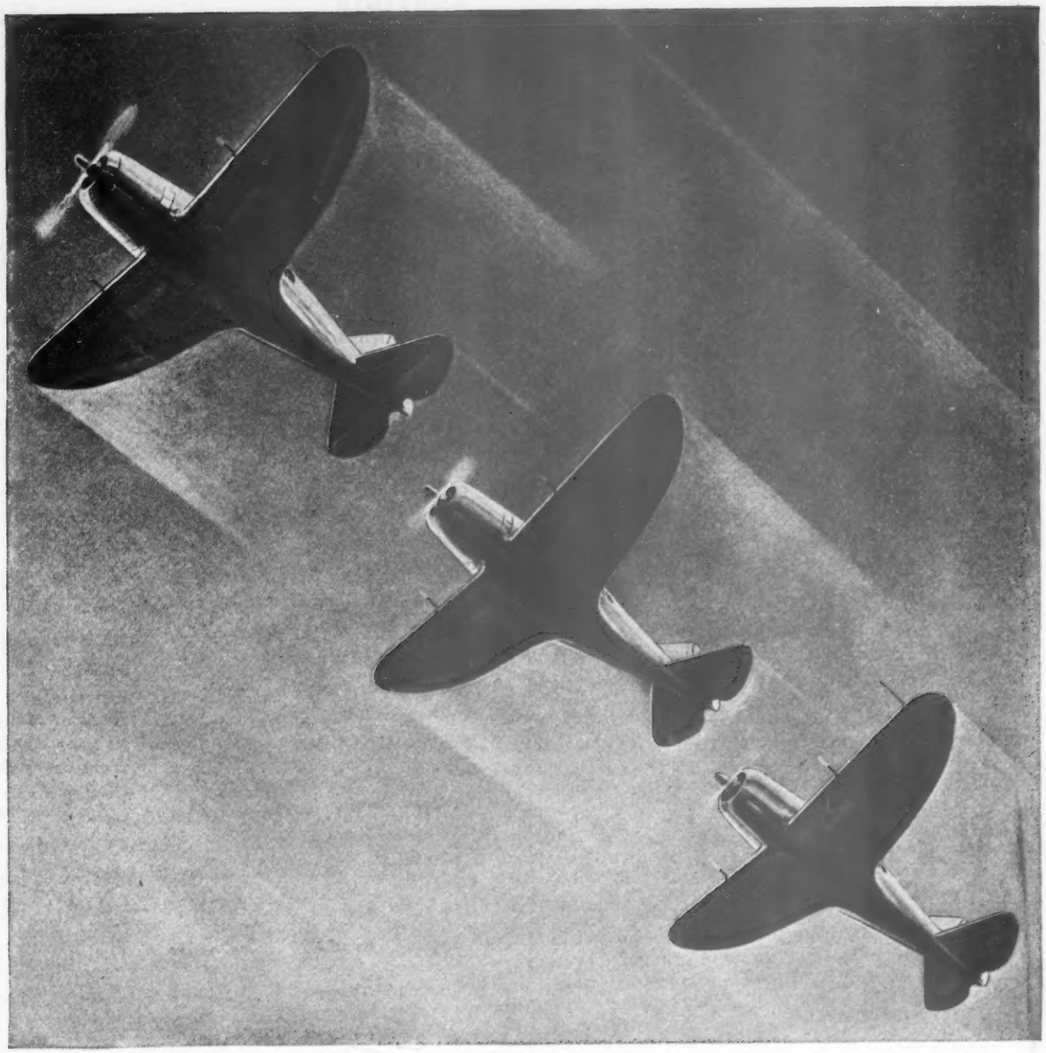


REPUBLIC AVIATION

AT 30,000 FEET . . . or higher, above the range of anti-aircraft fire, the modern bomber sets its course. Only pursuit aircraft can turn back this menace. Now, Republic Aviation has in regular production a fighter airplane—powered with the most advanced type radial super-charged engine—which retains *full tactical efficiency* at the extreme altitudes used in bombardment attack. Thus, once more Republic Aviation demonstrates that it is ready—for today's job and tomorrow's.

REPUBLIC AVIATION CORPORATION

FARMINGDALE, LONG ISLAND, N. Y.

FLASHES

picked up along the editorial airways

"Aviation" Leads Defense Expansion

» AVIATION MANUFACTURING HAS LED ALL INDUSTRY in expansion for defense, and, contrary to the contentions of some misguided columnists and congressmen, has stuck its neck out so far in the interests of pure patriotism that few bankers would care to go along. As this is written all but two of the plane and engine makers have taken definite expansion steps and announcements probably will be forthcoming from them within the next few days. Meanwhile Congress is so busy with complicated pre-election evasion of the draft issue that it has had no time to do much besides making a few preliminary passes at revising the discriminatory profit limitation and amortization legislation that has caused so much uncertainty in financing expansion.

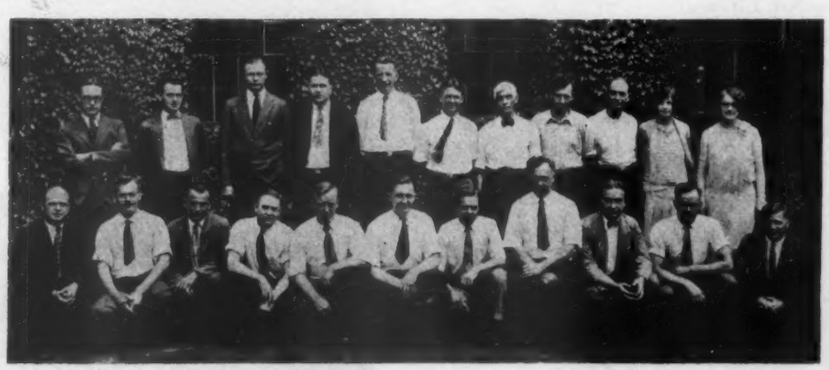
» ONE OF THE TROUBLES with columnists is that they think 7–8 percent is a fine return on your money and it is. But they don't understand that this is gross profit and, when you trim it down with taxes and all the other things a government auditor can take out, you are very lucky to wind up with 3½ percent. They also forget that companies are made up of a lot of individual stockholders who could sell their stock and buy up a nice profitable hat-checking concession in a New York night club to make more money.

Fortunately the Army, Navy, and the Defense Commission appreciate the manufacturers' problems and have done much to clarify public thinking. The recent statements of Secretary of War Stimson, Defense Commissioner Knudsen, and John D. Biggers, head of the Defense Commission taxation and finance committee, are particularly enlightening.

The way things look now, no two aviation companies will use exactly the same financing methods. Most of them have gone in for RFC commitments, others for private loans, and still others for operating fixed fee operation of government owned shadow plants under lease. The RFC loans are all right if they are made to subsidiary companies so the properties of the parent organizations do not become involved. Private financing is fine if you can get it. Government owned plants will work as long as they are operated by existing private manufacturers. But if the government tries to operate them it will divert needed key personnel from our armed forces, it will cost much more and produce much less than any other method, and it will start us on the same road to demoralization and defeat that ended in the fall of France.

» ENGLAND ISN'T FALLING as fast as Hitler and some other prophets predicted. The Aug. 15 deadline for the occupation of London has come and gone and the world is still waiting for the blitzkrieg. The time is growing short before the notorious London fogs may mean the salvation of the Empire. But fog or no fog, win or lose, the almost miraculous performance of the Royal Air Force will go down in history as one of the greatest military achievements of all time. And it is beginning to look as though the British and probably a lot of other people may be eternally indebted to the RAF for the preservation of their institutions and ideals.

Fifteen years ago—The original Pratt & Whitney Aircraft group. This photo shows 22 of the 25 people on the Pratt & Whitney roster in December, 1925. Standing (l. to r.) are: C. W. Deeds, G. J. Mead, F. B. Rentschler, H. Gunberg, J. J. Borrup, David Robinson, H. Cudworth, F. Irmischer, W. P. Jones, Anna M. Reardon, Marie Wilkinson. Sitting: A. V. D. Willgoos, E. A. Ryder, L. Castonguay, R. M. Campbell, D. Jack, W. J. Levack, C. Peterson, A. Hokanson, D. L. Brown, N. King, and P. Treffert. C. J. Marks, E. H. Godfrey, and T. Carlisle were not on hand when the photo was taken.



BEHIND THIS NOSE

Behind the eager, modern contours of the Fairchild Trainer M-62 stands a solemn pledge guaranteed by a famous heritage of performance and accomplishment. With fourteen years of experience in the manufacture of quality aircraft—with approximately one thousand of its planes in current service throughout the world, renowned for their rugged construction and unexcelled flying characteristics—with its splendidly equipped plant, tooled and staffed for quantity production—with a prestige well earned and internationally enjoyed—FAIRCHILD is fully qualified to produce this many-featured military trainer to the entire satisfaction of the most exacting users! The Fairchild M-62 is now in quantity production for the U. S. Army Air Corps.

FAIRCHILD AIRCRAFT

Division of Fairchild Engine & Airplane Corporation

Hagerstown, Maryland . . . Cable Address "Faircraft"

» BEHIND THE MAGNIFICENT PERFORMANCE of the RAF is the supreme Anglo-Saxon confidence and indomitable spirit of the British people all the way down the line. We have reason to believe that London life hasn't been too much fun in the last few weeks, yet there is no diminution in the unique British sense of humor. We have talked with several recent arrivals from the beleagured isles and their confidence is supreme. In further evidence we present (on page 34) a special cablegram to AVIATION from our old friend, C. G. Grey, who gives us first-hand impressions of one of the bombing raids on London. Upon reading it you will find the war has not changed his sardonic literary style. You will also be interested in his prediction of retaliation on Berlin, which has come to pass in the last few days, and in his claim that British production has caught up with that of the Germans.

» ENOUGH OF WAR. Let's look at the opening pages of this issue for the more refreshing peacetime accomplishments of domestic air transport. We are celebrating the twentieth anniversary of the completion of the first transcontinental route with some interesting comparisons of operations then and now. Air transport history divides itself neatly into two decades of preparation for the flying forties. The twenties were devoted to pioneering effort and the often tragic struggle to pull our borders closer together in terms of time. The thirties were the years of streamlining and consolidating the hard-earned gains of the pioneers, of perfecting safety and learning when *not* to fly. And the forties have begun with a firmly founded public acceptance of air transport as first-class transportation. It is hoped that we will soon see lower rates of fare, second-class airline service, feeder line development, far greater air express volume, and possibly a time-payment arrangement for pleasure and vacation tours similar to that instituted recently by the railroads.

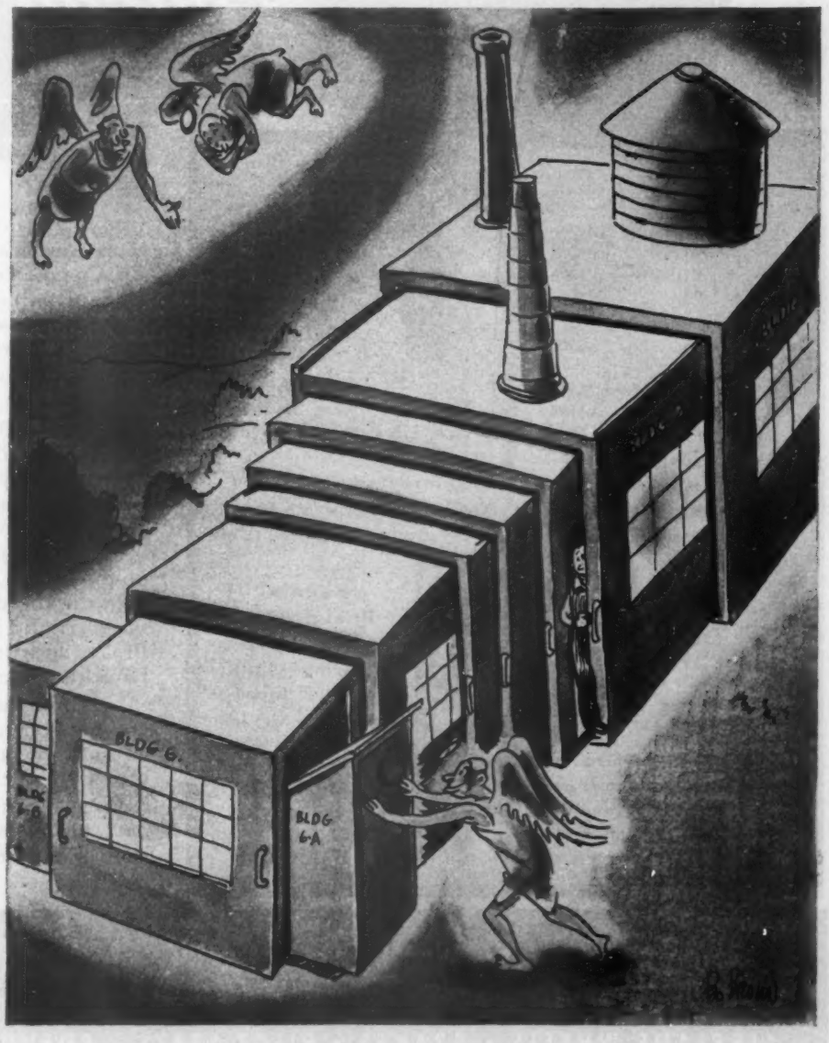
» BUT AIRLINE PROGRESS will be cramped unnecessarily and unfairly if the proposed excess profits tax legislation emerges from Capitol Hill in its present form. They would be penalized by small exemptions because of the poor showing during the last few years —a period when they were plowing back their earnings into new equipment and improving their facilities. Col. Edgar S. Gorrell of the Air Transportation Association of America has presented these facts clearly in the hearings and it is hoped that Congress will see the light.

» THE PRESIDENT HAS ABOUT-FACED once again. This time it should be beneficial to the industry because he now approves a major airport program. It looks as though the dusty airport report made by the CAA shortly after it was established would be taken off the shelves and used as a basis of expansion of the airport system. The program will cost $200,000,000 to $500,000,000 and calls for many new ports and relief of the congestion in the New York area. Cooperation of the War and Navy Departments with the Civil Aeronautics Board assures consideration of defense needs in the airport picture.

» A P & W ADVERTISEMENT for a draftsman came to our attention the other day and we were both interested and gratified to read the closing sentence, "Inquiries from personnel employed by other manufacturers engaged in national defense production not desired." Until very recently there has been too much personnel turnover and some pirating in the aviation business. P & W is to be highly commended for this clear expression of policy. Aviation manufacturers concerned with the defense program have taken the lead in prevention of piracy. Their farsightedness should serve as an example to other defense industries faced with the problem of expansion and with shortages of highly skilled and technical personnel.

» OLDTIMERS WILL SPEND this Labor Day with their families for the first time in many years because there are no National Air Races. Three major shows will be sponsored next year by N.A.A., with Steadham Acker managing them, probably in New York, Chicago and West Coast.

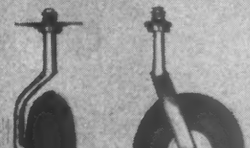
IT PAYS TO FLY



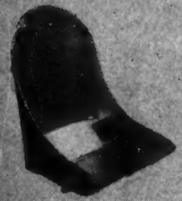
Maguire is building a telescopic plant to solve his amortization problems.

Such Bendix units have made MILLIONS of "Happy Landings"

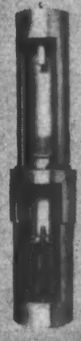
Bendix Wheel and Brake—Low air resistance, due to smooth contour; a type in general military service.



Bendix Tail Wheel Knuckles—Steerable and swivelable, thus increasing ground maneuverability appreciably.



Bendix Pilot Seat—Developed for military aircraft. Weighs 7¼ pounds. Subjected to 3800 pounds deadweight loading test.



Bendix Pneudraulic Shock Struts—The impact shocks dissipated hydraulically, taxi-ing shocks pneumatically. Designed individually for particular load requirements.

More Americans are flying every month... American Air Commerce sets new records of passenger volume, of mileage, of safety. Why? Because public *confidence* grows greater and greater, inspired by the admirable carefulness of our whole industry.

We all know that nothing inspires passenger-confidence so surely and strongly as smooth take-off and landing and taxi-ing.

Bendix builds that . . . custom engineers it, to order, for any airplane . . . follows it through with service assurance that means peace-of-mind for the airline operator.

Years of painstaking analysis of every force set up during the critical moments of ground-contact, underlie the design and dimensioning of Bendix Pneudraulic Shock Struts, Bendix Wheels and Brakes and Bendix steerable and swivelable Tail-Knuckle Assemblies.

Initial impact shocks and the lesser bumps of taxi and take-off runs are efficiently absorbed; deceleration is effected in minimum distance and with direction nicely controlled.

Every facility, every compilation of landing-gear data, every benefit of Bendix' years of experience in this specialized work, is at the industry's command.

BENDIX PRODUCTS DIVISION

OF BENDIX AVIATION CORPORATION · SOUTH BEND, INDIANA

AIRPLANE WHEELS · BRAKES · PILOT SEATS · PNEUDRAULIC SHOCK STRUTS

By Robert Osborn

» BY THE TIME this appears, National Aviation Day, August 19th, will have been celebrated, set aside by Presidential Proclamation inviting "the people of the United States to observe the day with appropriate exercises to further and stimulate the interest in aviation in this country."

This is all very nice, Mr. President, but considering present emergency conditions in the aircraft industry we're wondering if you couldn't also set aside another day strictly for the people in the industry, to be known as "National Who Cares About Aviation Day". On that one day everyone connected with the industry could go fishing, play golf, or possibly just rest under an apple tree and smoke a corn-cob pipe?

» FORCED LANDING At the drafting table next to mine sat a man who is one of the best in the business. He has been drawing airplanes since the bamboo and bailing-wire days and knows them from A to Izzard. All of the new designs of the company are worked out on his board and he contributes more good ideas to them than he is generally given credit for.

Most of the day he sat working along quietly, stopping occasionally to brush a fresh deposit of cigar ashes from his drawing, however when something happened to disturb the even tenor of his way he would break out into a display of profanity which was really masterly. As I have been much in the company of longshoremen, contractors, newspaper men, and pilots in my time, when I say that his command of sulphurous and searing words was masterly, it is to be understood that I know whereof I speak. Whenever he put his elbow down on the point of a thumb-tack, or the designer sketched all over his drawing with a hard pencil, as all designers do, or the aerodynamicist wanted the upper wing moved two feet, the eruption would be as regular and as impressive as that of "Old Faithful." And his performance was all the more remarkable in that a lady stenographer sat ten feet away from his table, and he had to achieve vehemence without raising his voice above a whisper.

One day this draftsman was working along contentedly, leaning back on his high stool and with his feet propped up in the cross rods under the table, when, without even a warning crack, his battered and ancient drafting stool suddenly collapsed,—disintegrated as completely and thoroughly as the one-hoss-shay, with pieces of kindling wood flying in all directions, giving him a free fall three feet to the floor where he landed on his rump. Eye witnesses argued for days afterward as to whether he had bounced two or three times. The entire drafting and engineering personnel gathered 'round to help him up, and when we were sure he had not been hurt, a hush fell on us as we waited for the molten words to flow. Here, we all thought, was an occasion worthy of the master,—new heights to which he alone could rise,—a swearing record to be set which would stand for all time.

He brushed himself off, said "Holy Smoke" in a quiet voice, and went back to work on his drawing.

» A FELLOW WE KNOW has been brooding about those 50,000 airplanes. "Where will they park all of them?" he keeps asking. So we turned the problem over to our office boy, whose chief ambition is to use a slide rule. We dug one out of our bottom drawer, oiled it up for easy use, and gave it to the boy. We told him to take the dimensions of a pursuit plane and multiply by 50,000.

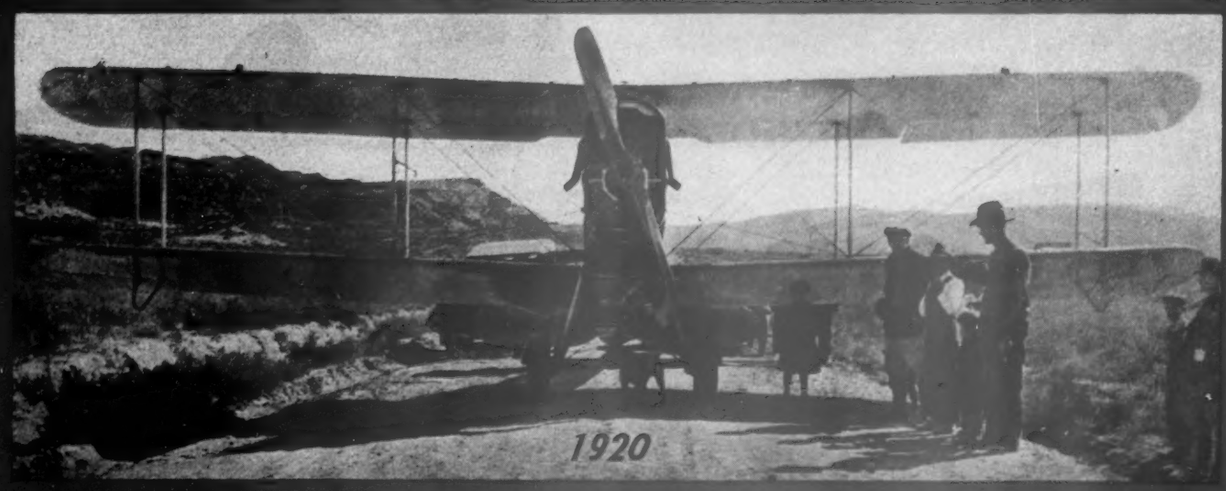
The boy borrowed our copy of, "Here's How with a Slide Rule" and went off to his favorite spot in the basement to begin his cogitations.

Pretty soon he came back with a worried look. "Doesn't come out right," he said, "guess there wasn't enough oil on the slide rule."

"Look," he said, "a field would have to be only 1½ miles square."

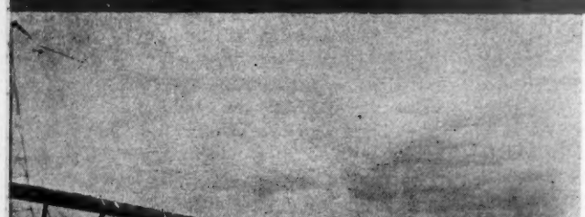
» THE INTREPID AVIATOR says he doesn't know what the younger generation is coming to. He read in the papers that the students under the C. A. A. training program had established a custom whereby a student pilot's shirt tail must be torn off by the rest of the gang right after landing from his first solo, and when a girl student soloed the other day they even tore off a section of her slip.

When he learned to fly, he commented between puffs on one of our cigars, all that happened to a solo student was that he caught varying degrees of hell from his instructor depending on how often he bounced the Jenny before being able to get it to stay on the ground.

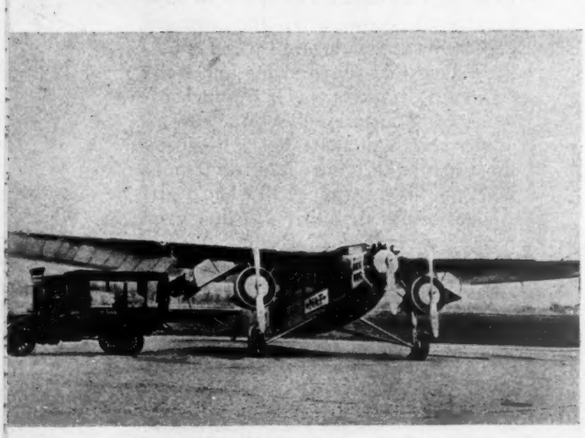


TWENTY YEARS OF

By Carl Norcross
Assistant Editor, AVIATION

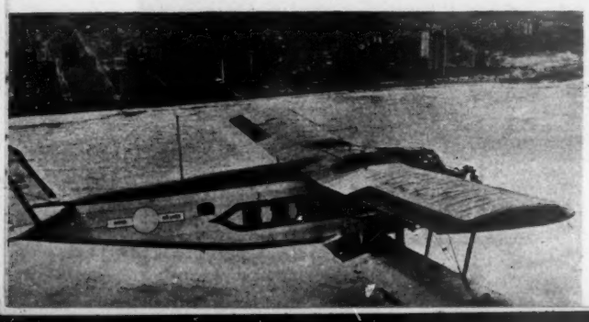


Above: an old De Havilland mail plane after a typical forced landing. This ship was being flown by Pilot Collinson on the Cheyenne-Salt Lake run in 1923 when his engine burned out. Plane was towed to Point of Rocks by auto where a new Liberty engine was installed.



Left upper: a Boeing 40, the first of the passenger-carrying mail planes, built for Boeing Air Transport in 1927. Pilot sat outside, two passengers rode in a small cabin forward.

Left center: then came the Ford tri-motor, known as the "Tin Goose", a rugged but very noisy airplane. Note mail compartment in wing, lowered for loading. Insignia is National Air Transport, a predecessor of United Air Lines.



Lower left: a tri-motored Boeing 80, which could carry twelve passengers plus a load of cargo. These planes were used until outmoded by the much faster Boeing 247.

AIRLINE WEATHER MEN were not always the careful scientists they are today. In the early airmail days a pilot telephoned ahead to the caretaker of an emergency landing field and enquired, "How high is your ceiling?"

The caretaker took a quick glance around his office and replied, "About 10 ft., I think, but if you wait a minute I'll measure it."

Another pilot, telephoning to a field for information, asked, "How's the weather?"

"Not so bad for this time of year," said the caretaker.

These two incidents are typical of transcontinental flying of twenty years ago when a pilot flew alone in an open-cockpit airplane, behind an engine that might let him down at any moment, with no adequate weather forecasts, no radio, and only his own wits to guide him.

The 20th anniversary of the first coast-to-coast airway is being celebrated this month. On Sept. 8, 1920, the last leg of the air mail route running from New York to San Francisco was completed and air mail pilots began flying daily schedules along this great stretch of country. From that beginning has come "U.S. Air Mail Route

AIRLINE PROGRESS

No. 1" which is flown by United Air Lines today.

The growth in commercial airlines has been so rapid that travelers reclining comfortably in the great air transports of today have difficulty thinking back to only twenty years ago, when an air route spanning the continent was just beginning. Yet in 1920 it had taken a tremendous energy and determination, as well as pioneering spirit, to tie the West Coast and the East Coast together with regular service.

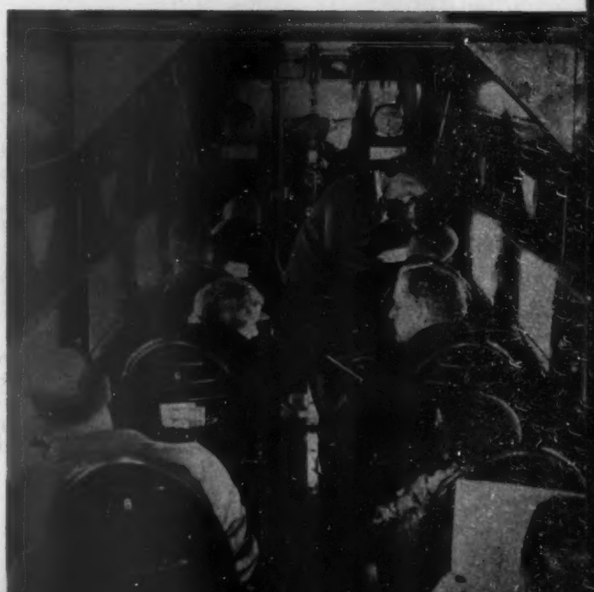
First of the air mail routes that were later to form a transcontinental airline was the Chicago to Cleveland run which opened on May 15, 1919. On July 1 of that year the Cleveland-New York service was started. Mail routes were pushed westward on May 15, 1920 when the Chicago to Omaha service was established. Then, on Sept. 8 of that year, with the opening of the Omaha-San Francisco route, an airway linked the Pacific and the Atlantic for the first time.

Ox teams had given way to stage coaches and the pony riders express, which in turn had been superceded by railroad trains belching their smoke across plains and mountains. Finally came the airplanes—not very fast, or not at all modern by today's standards—but airplanes that were to lead on in a brief score of years to the luxurious overnight travel of today between our eastern and western shores.

(*Turn to page 102*)

After twenty years of evolution, the smart Mainliner shown above has been developed for passenger comfort. Carrying 21 passengers by day, or sleeping 14 at night, the Douglas transport swoops majestically along the line flown formerly by planes on the adjoining page.

Right: the interior of a Mainliner today is the essence of comfort. Passengers ride in deeply upholstered chairs with individual reading lights and individual ventilators. A United stewardess is trained to attend to travelers' wants, and serve them hot meals. Improvements in speed have kept pace with those in comfort.



Lower right: the interior of a Ford tri-motor. Modern planes are one-fifty-thousandths as noisy as the Fords. Emphasis in these ships was on utility rather than passenger comfort.

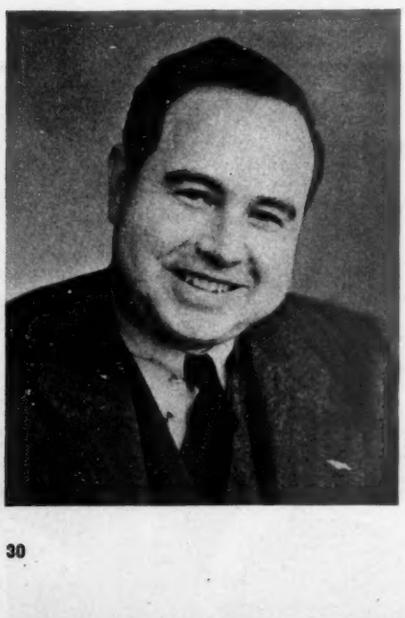
AIRLINE RESEARCH

Research of today indicates what will be the air transportation of tomorrow. The thoroughness of its work brings every passenger under its constant investigation.

By Jay P. AuWerter, *Assistant Editor, AVIATION*

ANYONE can walk, but it is only the wise man that knows where he is going. In the same light most anyone can fly, but it is only the wise airline that knows how it is going to do it. In these few simple words is summed up why United Airlines a little over a decade ago first opened its doors to a promising research engineer and since then has spent nearly half a million dollars and endless time in its contribution to safe air travel.

The research engineer was Thorpe Hiscock, a western rancher with a flare for radio. His hobby became his profession later when his work carried him to the position of head research engineer for United. Developing the first two-way voice radio communication will be a lasting tribute to the ability of this man, and it will long be remembered by United, as it was the beginning of their present research organization. The early history of the department is closely allied to the name of Hiscock and it was through his genius for development that many projects of untold value to the airline were put in use.



Through the 1930's the importance of research took on added significance and has grown in size until today it has been divided into three separate branches. The original group working with Hiscock, with added members, has been left more or less intact under what is known as the communication section. The engineering research department tackles all other problems dealing with the mechanics of air transportation as regards more efficient operation of the airliner. Then there is the third branch, established comparatively recently, which comes under the medical department, and looks into the whys and wherefores of passenger and personnel health during airline operation.

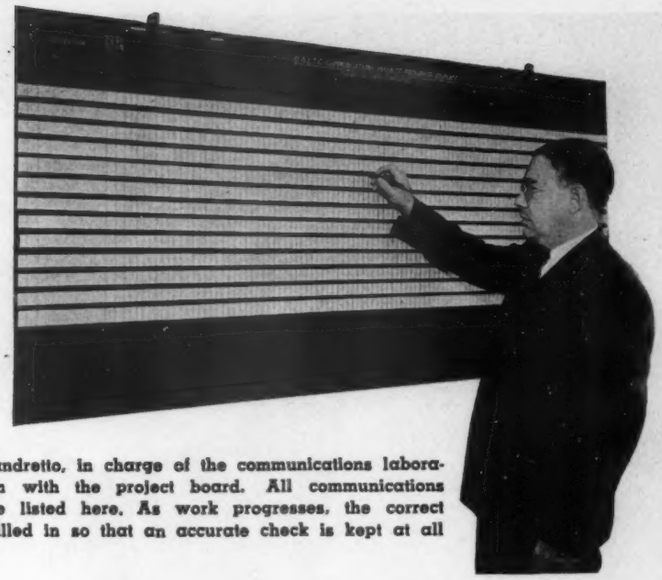
During the past ten years, United has spent an estimated $400,000 on technical research to advance air transportation. In an industry where profits are small and capital investment is high, United was farsighted enough to see that money spent for research even during the profitless years of depression would sooner or later reap large dividends in business volume—and it has. In some instances, economies were shown directly on the balance sheet, but even more than this, each development has brought the airline closer and closer to its goal of safe, efficient, rapid operation.

"The keystone of United Airlines operations program is its rule of three, which governs the movement of every

J. A. Herlihy, left, vice president in charge of operations. Right: the vibration machine, on which communications devices and flight equipment are tested to insure ruggedness in flight. Control table is in foreground.

airplane on the entire system at all times. This rule of three sets forth, in order of respective importance, the factors of safety, passenger comfort, and schedule performance, as those which control the dispatch and flying of planes. In every phase of United's operations safety is always the primary consideration."

From the rules and regulations that United has set down, comes this statement giving the clear-cut reasons for the research department, which works with the rule of three foremost in its mind. One need spend only a short time talking with the men in charge to be convinced that this is true.



Peter C. Sandretto, in charge of the communications laboratory, shown with the project board. All communications projects are listed here. As work progresses, the correct square is filled in so that an accurate check is kept at all times.

Research Organization

All of the research activities come under the jurisdiction of the vice-president in charge of operations, J. A. Herlihy. Communications is headed by J. R. Cunningham, with Pete Sandretto in charge of the laboratory and the development of new radio equipment. Engineering research comes under Ray D. Kelly, who has with him four project engineers, each in charge of a separate department. Col. A. D. Tuttle, M.D., formerly of the Army Aviation Medical School at Randolph Field, Tex., takes care of the medical department as well as all details connected with flight medical research.

Each of the various departments has its own facilities. However, there is also equipment which is available to all three. Foremost is the flight research plane, the only one of its kind in the world. This ship, a converted Boeing 247-D transport, has proven to be an invaluable asset to the progress of United's enviable research program.

Then there is the altitude chamber which enables the simulation of actual conditions and altitudes varying from sea level to 65,000 ft. The chamber is used in a variety of projects including radio apparatus testing to insure proper operation, oxygen tests in connection with the provision of oxygen for passengers during high altitude flight, instrument testing for variations due to rarified conditions, besides many other types of equipment and problems which will present themselves when airlines start regular high altitude operations.

In a cold chamber, engineers are able to simulate conditions of temperature and humidity ranging from — 50 deg. F. and zero percent relative humidity to + 125 deg. F. and 95 percent relative humidity. Much of the equipment tested in the high altitude chamber must also be put through its paces in this chamber so that there can be no doubt as to its efficient operation.

The vibration table is another piece of equipment, specially designed by the United's engineers, to test radio and other equipment which is susceptible to various forms of vibration. Finally comes the drop table which gives equipment the acid test by a sudden drop of 18 in. on to a hard metal surface. United Airlines is the only airline in the world to possess these various forms of special research testing equipment and when some piece of apparatus has successfully made the rounds there isn't much doubt that it will operate under practically any conditions.

Communications Laboratory

Pete Sandretto, head of the communications laboratory, has a staff of nine engineers, two mechanics and two draftsmen. The lab was originally formed in 1929 and, stationed at Oakland, Calif., consisted of a group of three men headed by Thorpe Hiscock. In 1939 it was moved to the La Salle-Wacker Building in Chicago, and from there in

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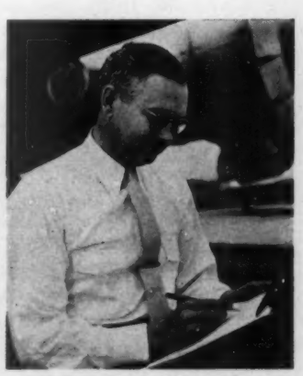
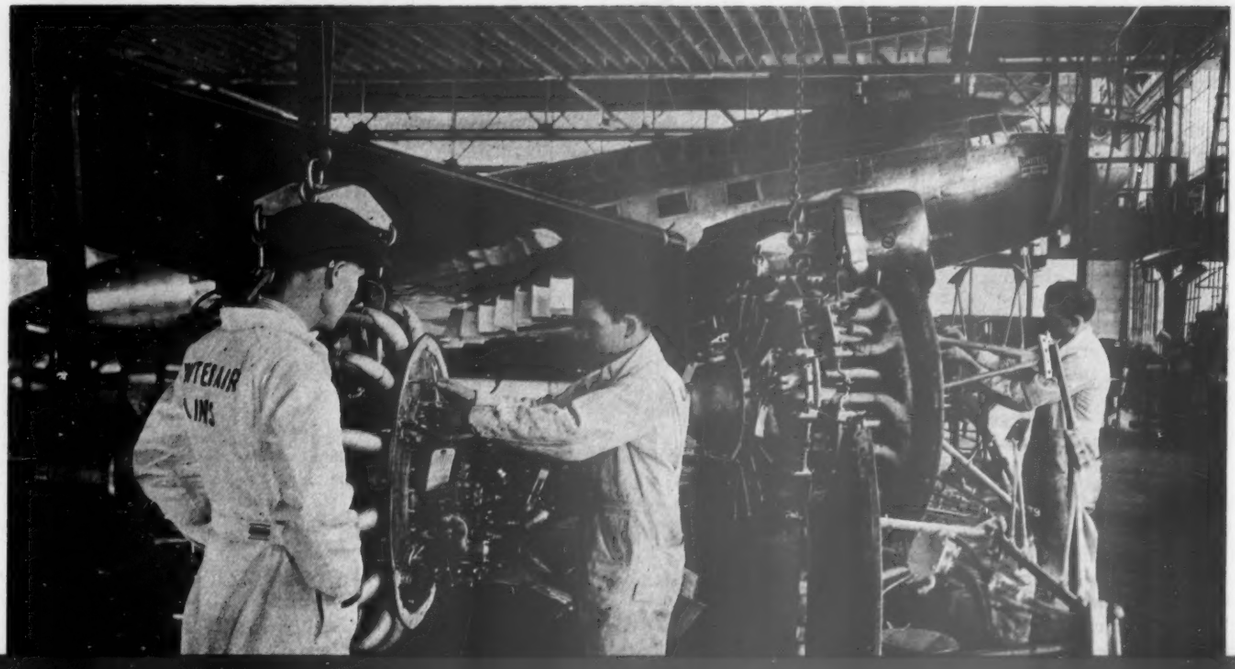
J. R. Cunningham, in charge of communications research. Under his supervision, United has made numerous contributions to radio research, and operation.

A portion of the research laboratories. In the foreground are benches where equipment of various sorts is built. Through the doors on both sides are test equipment, including the vibration table, high altitude testing, cold chamber, drop test machine, the acid test for new equipment.



Ray D. Kelly is in charge of engineering research. He and his four project engineers work to build passenger comfort and improved design of all sorts.



Mainliner Maintenance

"AIRLINE maintenance has come a long way since the old days," said one of United's officials recently. "At Maywood Field just outside of Chicago, where we used to overhaul the mail planes, we had only one spare compass, and we didn't know how to compensate or overhaul it. Compasses were unreliable then and when a pilot complained that his compass was not right we installed the spare and put his on the shelf. When the next pilot complained, *he* got the spare, and so on. Today we not only know how every instrument and accessory operates, but we have test equipment for it. When equipment goes back into an airplane after an overhaul, we *know* it is going to work properly. There is no guessing today. Now we're sure."

Air travel has become so uniformly excellent in recent years that passengers seldom catch the real spirit of the maintenance mechanics. Airplanes are safe, engines are dependable, the passenger gets where he wants to go—New York to the West Coast over night if he wishes—and both speed and safety are taken for granted. The part that maintenance plays in today's superlative airline performance is seldom front-page news to the air traveler.

Maintenance mechanics along United's coast-to-coast lines are among the most critical men in America. St. Peter standing at the pearly gates doesn't look over his applicants any more carefully than these airplane and engine specialists do their particular part of an airliner when a ship comes rolling into their hangers. Perfection in past performances means nothing to them. They look for trouble, and they find potential trouble long before it becomes serious.

Seeing is believing, so let's watch the mechanics and inspectors as the Mainliners fly into Cheyenne where United's overhaul shop is located. The airliners are inspected daily by skilled mechanics along the run, but at 600 hours they are routed to the shops for what United calls a plane overhaul. They could run much longer, but this is a conservative time limit. It is conservative in the same way that you might decide to change the oil in your car at 400 or 500 miles instead of the 1,000 miles recommended by the manufacturer.

So after 600 hours of flying time, each Douglas is routed to Cheyenne. It is manouvered into the hanger and its nose comes to rest at a spot where overhead work stands may be lowered along each side of the pilot's cockpit. Two portable stands, mounted on rubber-tired wheels, are locked in position below each of the great twin-row Wasp engines. A portable test bench for checking the hydraulic systems is also moved into position.

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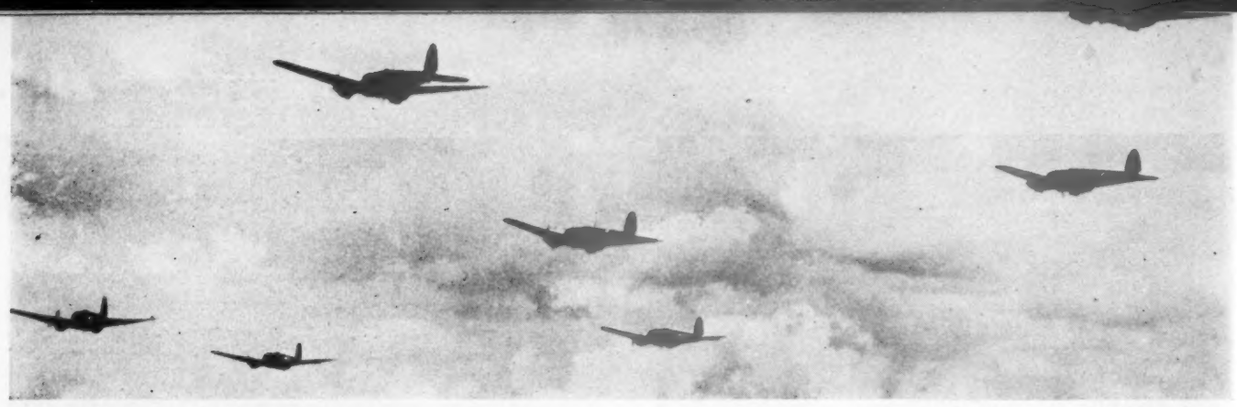
United Air Lines takes great pride in its mechanics. There's ample reason!

After 600 hours of flying time, United's Mainliners are routed to Cheyenne for a plane overhaul, at which time the engines are changed, as shown on the opposite page.

Above: One of the two drophammers in the sheetmetal shop, on which are formed scores of different parts.

Above right: Spark plugs are but one of the many pieces of equipment that United mechanics disassemble, clean, and test at the Cheyenne maintenance base.

Right: A portion of the engine overhaul shop. Every 600 hours engines are removed from planes, wheeled into this shop and disassembled down to the last cotter pin. After being cleaned, parts are microscopically inspected and approved parts are assembled. Engines must run four hours on the test stand and perform perfectly in a test flight before being approved for a regular run.



British Press Combine

BOMBING OF LONDON

By C. G. Grey

Special Cable to Aviation

THE August 16 bombing of London is like Mark Twain's comment on the report of his own death,—greatly exaggerated. At this time the only bombing is a southwest suburb, as officially reported, and Croydon Aerodrome which anyhow ought to have been rebuilt or abolished ten years ago, and bombings to east of London far outside London area.

Naturally censorship will not allow details of bombing of Croydon but one may say that German attack of perhaps a dozen dive bombers with attendant fighters came through high cloud without warning directly from the direction of approach of Dutch, Belgium, and German airliners before war. French used to come up from south.

First notice of their presence to those in offices and workshops was bursting of bombs. Number of killed and wounded necessarily withheld but may not have been large judging by results at other aerodromes. Equally one cannot specify damage done either to RAF equipment or to work in progress but Croydon is not a first class aerodrome and there are no workshops of leading aircraft constructors within many miles from it.

Attack seems to have been retaliation for our raid on LeBourget main Paris aerodrome now used as German assembly base for raids on south England, probably to gratify and increase anti British feeling amongst French and as pretended revenge for Oran.

There was no interference with the German bombers when coming in to bomb but Spitfires and Hurricanes were already among them before they were out of sight on the way back and none of them got home.

Naturally there are many munition works round London including aircraft works well known to Americans and Germans and the London telephone di-

British Pres

rectory but none of first class importance in London area, therefore London is of less importance from industrial view than equal collective area of manufacturing cities.

Even as seat of government London is not essential. King Alfred ruled his South Saxon England from Winchester and beat out the Danes. Most government departments have dispersed their human operating machinery to different parts of the country. Heads of departments and immediate staffs in London itself are well protected by solid buildings of past centuries instead of mere steel and concrete.

Some cynics argue that destruction of some government departments would materially accelerate progress toward victory. I could easily give individual examples.

All big aircraft and motor plants all parts of country have dispersal plants in other parts. If any one factory is destroyed production will still go on and no factory has yet been damaged enough to stop its production. New factories for parts and complete products are opening every week and output of provedly effective types has leaped upwards under Beaverbrook. Best estimates are that we ahead of German output.

No new German aeroplanes showing up yet but presume their designers not asleep. We have new types now in production far enough ahead of existing types to take care of anything they may produce.

Spitfires and Hurricanes beat Messerschmitt and Heinkel fighters on maneuverability and gunpower, though not so far better for offensive defense. Heinkel, Dornier and Junkers bombers easy meat for our fighters.

British Press Combine

Pilot and co-pilot of a German bomber. Notice the control column.

Superiority of our pilots and gunners shows advantage of hunting shooting and Rugby football over drilling and propaganda. Atmosphere of fighter station while squadrons going into action just that of Rugger Club sending team onto the field.

Lunching at fighter station recently intelligence officer called away came back grinning to tell commanding officer that a sergeant pilot separated in a cloud from his formation found himself with five Messerschmitts on top of him. He dived for sea and pulled up while following German dived right in. Squadron wanted to know whether fair to claim victory as no shot was fired. This seemed a more urgent problem than number of enemies shot down, which was taken as matter of course.

Figures for the past two days show what is coming to Germans who arrive in mass. Sporadic raids of small numbers more difficult to catch before they strike but fate of Croydon raiders will probably teach them they are too costly.

Rough calculations show that if German air force were left unopposed they would take about five years to reduce London to rubble. Even though we might not miss London much they will not be left unopposed.

Remember that Hitler has to guard two thousand miles of coast from top of Norway to bottom of France. Of this our ancestors from Scandinavia habitually harassed a thousand miles a thousand years ago. Watch us start doing it again. And Hitler cannot tell whereabout we have come to stay before starting for Berlin.

Wide World

A typical British anti-aircraft battery which dot the landscape of London. Here can be seen all of the units that observe the planes and control the guns. Key man is the one with the microphone that controls the fire.

IN AMERICA

HOW CIVILIAN SCHOOLS TRAIN MILITARY MECHANICS

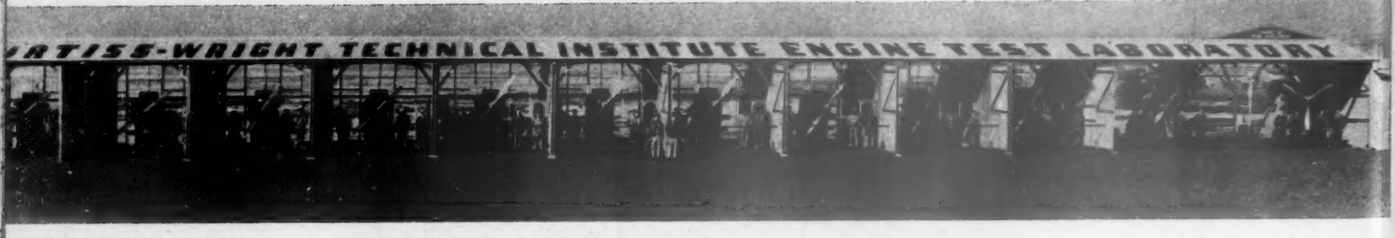
The private aviation schools in this country are doing a superb job in preparing mechanics for the Air Corps. This is an account of the air defense program at one school.

By C. C. Moseley, *President Curtiss-Wright Technical Institute*

BECAUSE we have been teaching boys how to make a living the Curtiss-Wright Technical Institute has become, in a period of ten years, the largest school of its kind in America. Other fine private aviation schools have also prospered and grown, despite the fact that we have a $4,000,000.00 public school machine in this country. While the public schools have remained steeped in the traditions of the past, the qualified aviation technical schools have kept step with the world's most vital industry.

That is why the U. S. Army turned to the leading private aviation schools of the country when an emergency arose which required the immediate training of thousands of competent aircraft mechanics. Our military men realized that the appropriation of bil-

(Turn to page 128)



Dimensions of the school match those of some complete factories. Many varieties of planes, engines and accessories are maintained for the 2,000 students.

Above, center. Large-scale engine training is possible through the operation of a bank of twelve engine test stands. Complete engine procedure is demonstrated with this equipment, including installation, adjustment, running in, servicing and inspection.

Left. Some of the school's special equipment. This full-scale retractable landing gear is mounted in a jig which duplicates the wing and engine nacelle of a plane. Students learn the operation of this hydraulic mechanism without benefit of the actual plane.

IN GERMANY

NAZI YOUTH ARE TRAINED FOR AVIATION

Training is the primary plank in the Nazi aviation platform. Boys begin with small model planes and proceed step by step until they are flying in Germany's combat airplanes. Here are a few lessons in their education.

Above, final machine gun instruction is in airplanes, with gunners firing at targets towed by other planes. Upper right: students take machine guns apart until they can do it blindfolded. This brings familiarity and skill in actual use. Below, left: machine gun practice, using real gunner's ring and gun, aiming at model plane. Lower right: students placing bombs beneath wing of an instruction bomber.

All photographs from European

Research Girds

Twin-engine model mounted in the propeller research tunnel.

SCIENTIFIC research in America has suddenly changed its complexion. A new and unpleasant necessity is facing the research worker in universities, in industry, and in government. A wholly new point of view is being forced upon him.

By choice and by instinct, America's industries have always been geared to a peace-time economy. By far the greatest part of our research effort has been directed toward producing cheaper and better goods that make for higher standards of living. We have been spending millions annually to improve our foods, our housing, our cars, and our aircraft. Comfort, safety, and economy have been the objectives. No one can doubt the essentially constructive nature of our industrial research.

But elsewhere this has not been so. Although the handwriting has been on the walls for many years, we are just beginning to comprehend something of the tremendous scope and efficiency of the German industries that are now feeding her war machine. Her industrial organization has been superb. The success of her armed forces has come about largely because she possesses carefully planned, well stocked, smooth running plants for the production of essential war equipment.

It is obvious, however, that no such industrial accomplishment ever springs full-blown out of nothing. It is only the result of *organization* to the nth degree. No visitor to Germany in the last few years could fail to be impressed by the breadth of planning, coupled with careful attention to the smallest detail, that characterized German industry. When *Der Tag* came—everything was ready and in its place—even to the last sharpened pencil. But organization alone couldn't do it all. Behind it was an accumulation of many years of patient work in research laboratories and careful experimentation with small-scale production. Simply by watching the magnitude and direction of scientific and industrial research in Germany for the past decade should have yielded clues aplenty as to what Hitler had in mind. It is astounding that so many signs should have been overlooked or underestimated.

Germans have always been noted for outstanding research achievement in many fields. Their chemists, their metallurgists, their aerodynamicists, have always been of the first rank. Their schools and universities have been centers of research for years. Even during the blackest days of the middle nineteen-twenties, the fires of research were never allowed to go out. When the present leaders of the Nazi party came into power they recognized the part that research would play in their effort to remake Germany into a world power, and very astutely they concen-

For War

Talk of airplanes by the thousands has emphasized production problems, but research must go hand-in-hand to preserve the superior quality of our flying equipment. Here are the broad outlines of our plans to enable research to meet wartime requirements.

By S. Paul Johnston, *Coordinator of Research, National Advisory Committee for Aeronautics*

trated their earliest efforts on forcing the fires of research so that when the time came for their great military machine to begin to move, it could do so under a full head of steam.

No great military movement in history was as widely advertised so far in advance as was Hitler's drive across Europe. No country ever went to such pains to show the world what she had in mind than did Germany during the past four or five years. And no people have been as blind to the significance of events that transpired under their very noses as have been the democracies of Europe and America.

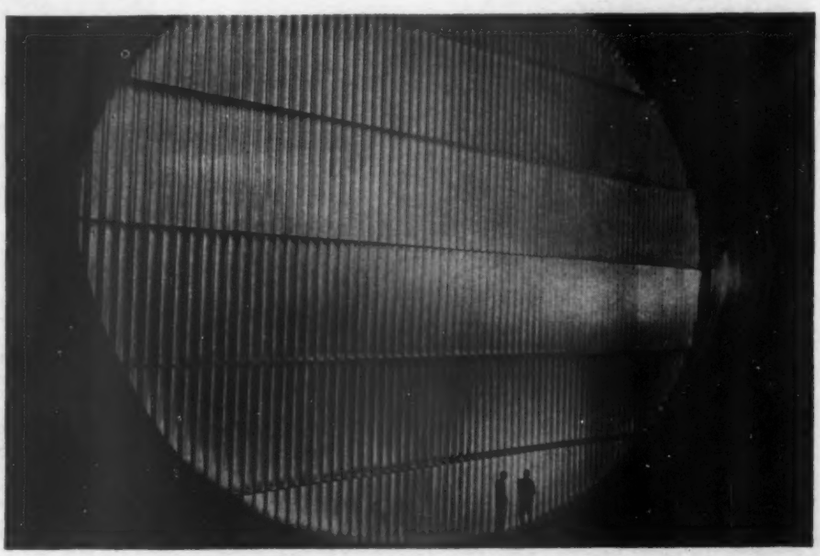
Far from concealing what they were doing, the Germans in the past few years have openly boasted of their attainments and have been ready and willing to show the world what was going on. Hundreds of visitors to German industry in recent years have been shown the great producing plants turning out airplanes, guns, and tanks, the great system of roads and railroads crisscrossing Germany from north to south and east to west, not to mention airports and landing fields on a scale far beyond the possible needs of her commercial air services.

Such things are largely the fruits of research. Looking back, it becomes increasingly plain that all German research of the past decade was aimed toward one objective—the creation of an efficient all-inclusive military machine. What the democracies failed to recognize in watching Germany's preparation over the past decade is the fact that there is no essential difference between peace-time and war-time economies of the totalitarian state. The transition from peace to war does not involve any tremendous changes in the internal program. The difference is

(*Turn to page 132*)

Part of the research plant at Langley Field, Virginia. Barn-like buildings at the left house the full-scale tunnel. Toward the center the 19-ft. pressure tunnel, one of the newest pieces of equipment. In the background, shops and engine laboratories.

To help wind around corners at 300 miles per hour, is the function of this huge grid-work in the 19-ft. pressure tunnel.



Curtiss Propeller Production

The Curtiss Propeller plant is one of the key units of the defense program. This is a story of the excellent job they are doing, after expanding more than twenty times their size in two years.

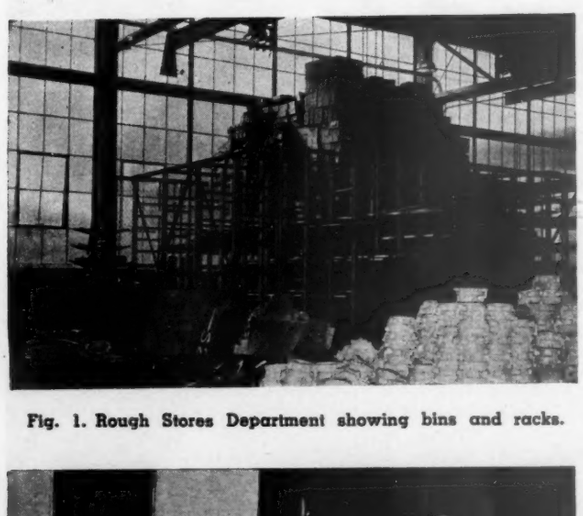


Fig. 1. Rough Stores Department showing bins and racks.

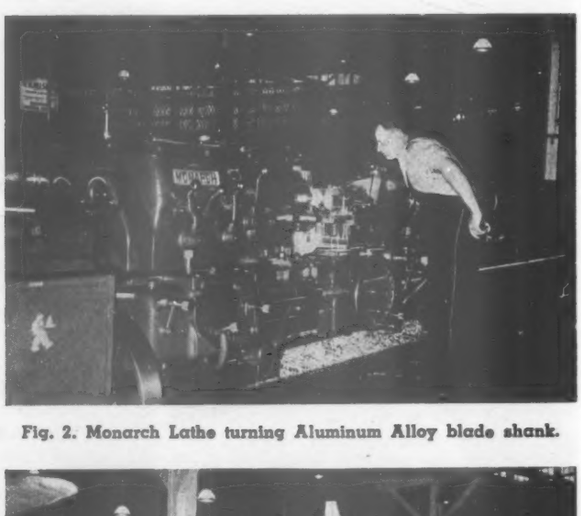


Fig. 2. Monarch Lathe turning Aluminum Alloy blade shank.

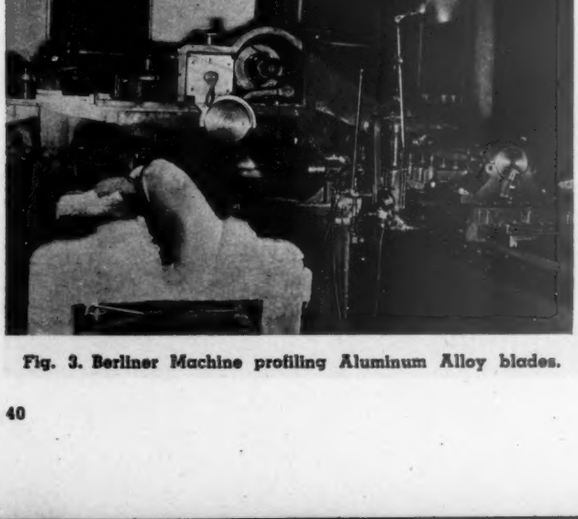


Fig. 3. Berliner Machine profiling Aluminum Alloy blades.

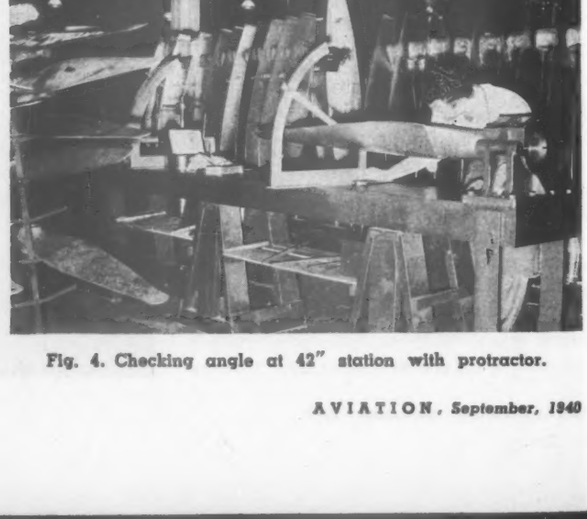


Fig. 4. Checking angle at 42" station with protractor.

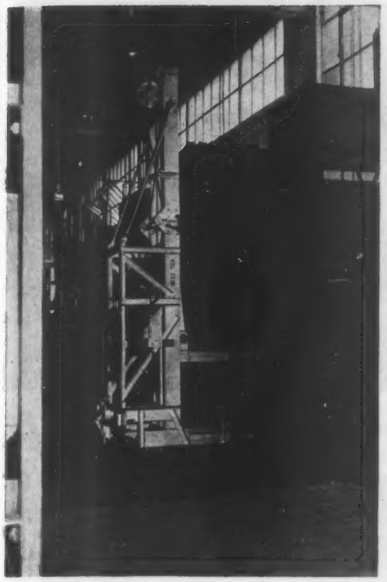


Fig. 5. Rough Stores Department showing storage bins and power hoist.

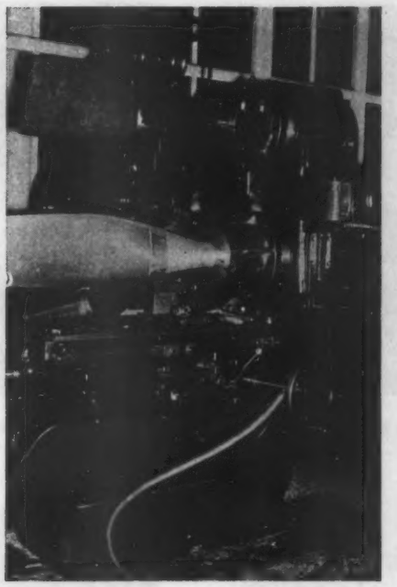


Fig. 6. Sundstrand Rigid Mill profiling blade shank from 18" station.

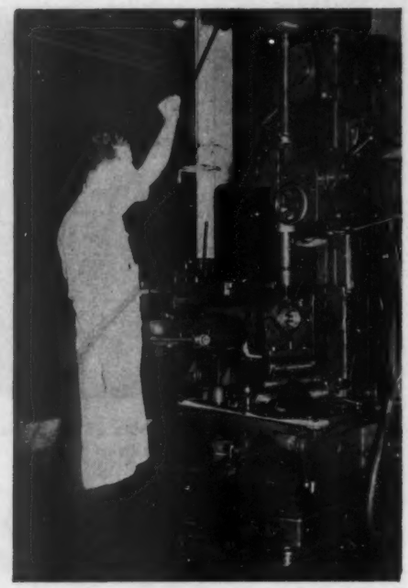


Fig. 7. Fosdick drill simultaneously drilling blade and blade gear.

A LITTLE over ten years ago there resulted from a pow-wow of Curtiss-Wright engineers what turned out to be the first plans of an electrically controlled propeller. The development work began to hum and the propellers began to fly. Step by step, work progressed and designs were perfected which ultimately led to the present familiar Curtiss Electric propeller and with it the Curtiss Propeller Division, being established as a separate manufacturing unit of the Curtiss-Wright Corporation.

Few people of ten years ago—even two or three years ago—thought the comparatively modest beginning of the Curtiss Propeller Division would mold itself into such a vital part of the present defense program. Willing to do more than its share, the company has undergone a tremendous expansion program which started with 17,000 sq. ft. at the Curtiss Aeroplane Division at Buffalo and has grown in two years to the present 135,000 sq. ft. at Clifton, N. J. plus 85,000 sq. ft. at Pittsburgh, Penn. An additional plant now under construction will provide a total of a half-million square feet when completed near Caldwell, N. J. in early October of this year.

The present 1900 employees now use a total of 220,000 sq.ft. About 1,300 of these men are engaged in actual manufacturing processes while the other 600 are divided up amongst the engineering, sales and office staffs. The new plant will make room for 1,600 new employees.

A description of the operation of the plant would not be complete without telling some of the preliminary work that is done before the propeller is actually scheduled for production. Orders coming into the plant from the customers are received by the Sales Department. Prior to the receipt of the order for new engine-airplane combinations, all of the necessary performance data is obtained. This is then turned over to the installations department and the technical section in order that the propeller design giving optimum performance can be selected (or that a new blade can be designed). Details of installations are coordinated with the installations department in order that the most efficient operation can be obtained, and the most desirable control arrangement be determined.

When this work has been completed, the information is turned over to the Sales Department to do the necessary interpreting and make the quotation to the customer. If accepted, the order is received and the sale order is issued by the Sales Department. Copies of this go to engineering, inspection, manufacturing, installations and the accounting departments. At this point the installations department checks further into the matter with the airplane manufacturer to make certain that the installation is correct.

When all of the performance data has been turned over to the Engineering Department and checked, a release giving structural details of the propeller is given out by them. These release sheets (Fig. 21) are made up according to the detailed parts numbers and the assembly numbers of the various units of the propellers. Of course, if the installation is a new one and not according to any standard installation previously designed, it may be necessary for the Engineering Department to design new detailed parts to meet the special requirements.

Releases are issued to the Manufacturing Department, through the medium of the planning and scheduling departments. This is the heart of the production system which sends out work orders to the various arteries of the production line telling them what to build and when. Along with the production schedule the Planning and Scheduling departments also directs the purchasing department as to the new material required to complete production of the new order. Purchasing in turn issues the necessary purchase orders with copies going to the accounting, inspection and receiving departments. Once all of this process has been completed, the shop is ready to start work on all of the material that will eventually comprise the propeller.

To facilitate the production, the plant has been divided into six departments, those being: (1) engineering, (2) manufacturing, (3) inspection, (4) accounting, (5) sales and service, and (6) installation.

Engineering Department

The Engineering Department is in turn broken down into three sub-departments. The first of these is the Research Department whose function it is to carry through on advanced stages of design of new ideas, both in regard to propellers and controls. It is from this group that the pioneering of ad-

Fig. 8. Hand filing Aluminum Alloy blades after profiling.

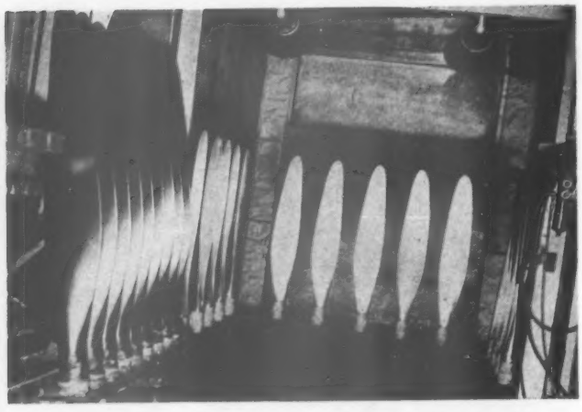


Fig. 9. Blades in paint spray booth before assembly.

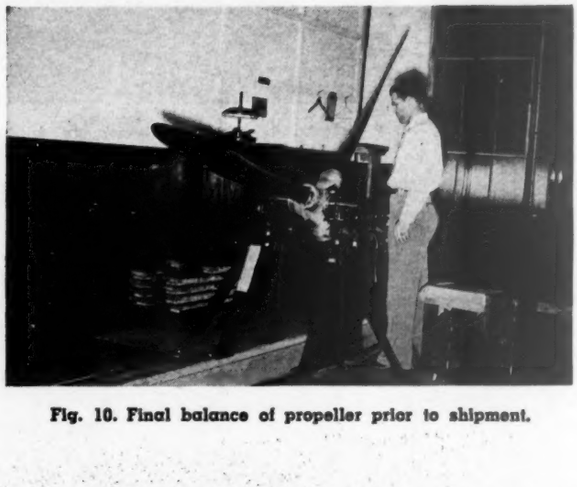


Fig. 10. Final balance of propeller prior to shipment.

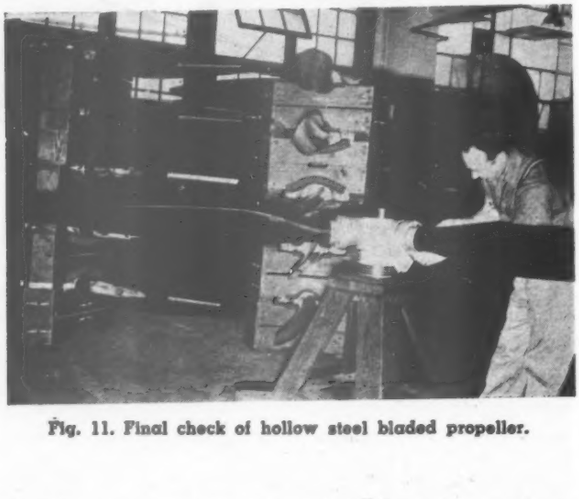


Fig. 11. Final check of hollow steel bladed propeller.

vance propeller design is carried out. They are the eyes of the Engineering Department which look into the future and see where and how propellers can be improved to make their efficiency increasingly better.

The experimental design and test section takes the developments from the research section and has the responsibility of developing them into a practical manufacturing unit. The experimental part of this department redesigns the research projects on the basis of coordinating with the production section to iron out production problems, while at the same time making certain that it is able to pass all necessary tests. The third group is the technical section whose job it is to guide the policy of blade design and selection from an aerodynamic viewpoint in order that the propellers will be available for new designs of engines and airplanes.

Manufacturing Department

The Manufacturing Department is divided into seven sub-departments, those being: (1) receiving, (2) planning and scheduling, (3) purchasing, (4) machine shops, (5) assembly, (6) shipping, (7) tool design and methods.

The head of the production line is the receiving department where all of the material from the outside suppliers comes into the plant. Here it is inspected and divided into the various categories depending upon what type of production is to be carried out on it in the plant. If the material has been completed by a subcontractor, it goes directly through inspection to the Finished Stores department to be placed in stock. If for further manufacturing by the company, and the raw material has been passed by the receiving inspection department, it is transferred into rough storage.

Aluminum Alloy Blade

The forged blade blanks are requisitioned out of the Rough Storage department (Fig. 1 and 5) against whatever shop order may have been made for that design of blade. From here it starts down through the production line which occupies nearly one-half of the main building. (See Fig. 12) The first operation is to center up the ends of the blade blanks, drilling a hole in the tip and the base of the blade and making certain that it is as nearly straight as possible. A Monarch lathe then turns down the end of the propeller (Fig. 2), cutting the hub close to its actual size. From here it goes into a Berliner machine (blade profile machine made by the Engineering Research Corporation) which turns down the blade to nearly its exact shape, starting with the 18-in. station out to the tip (Fig. 3). This operation leaves the blade to within about 1/64th of its actual size. The next step cuts the rest of the propeller blade from the 18-in. station in toward the hub. This operation is done on a Sunstrand blade profiling machine (Fig. 6). In this machine a master blade rotates at the same speed as the production blade and the two synchronized together so that the blade being cut takes exactly the same size as the master blade.

To make certain that the blade has not warped during all of the various machining operations, it is mounted on a checking table, (Fig. 4) the blade angle checked and the various stations marked. To remove tool marks the surface is filed down by hand (Fig. 8) so that it is uniform from hub to tip, the proper camber and alignment being assured by checking with templates, using the surface of the checking table as a reference plane. The gear mounted on the end through which the pitch is

changed, is held in the correct position by a set screw—the hole for which is drilled on a Fosdick drill (Fig. 7). It then travels into the buffing room to receive the polishing operations that put on almost a mirror finish. This completes all of the manufacturing operations on the blade. Afterwards it is balanced on a balance stand, being checked against a master blade. Once balanced, the blade is then painted (Fig 9), inspected, and sent to the Finished Stock Storage.

The Hub Department

The hub forging as it is received weighs approximately 400 lb. At the Curtiss plant 59 machining operations performed on this hub trim it down to a weight of approximately 50 lb., and this is no small job.

When the forged hub blank has been requisitioned from the Rough Storage Department (Fig. 1) it is mounted on a large Baker Bros. vertical boring mill for the first machining operation. In this machine a hole is bored through the center of the hub, where the engine shaft goes. The blade barrel and outer surface of the hub is then rough cut. A machine that handles three hubs at one time is used for taking the initial cut on the inside diameter of the blade barrel. After this is completed, the hub is mounted on a Hall Planetary-type milling machine (Fig. 14) and the inside and outside of the blade barrel is turned down. The operation of taking a rough cut from both the inside and the outside diameters of the barrel at the same time, is a new method of using this Hall machine. In order to prevent distortion while the hub is going through production, it is necessary to remove the material in small cuts. A double head Hydrotel machine is used for rough forming the contour of the hub between the barrels. This machine brings the shape of the hub down close to its actual size.

After all the rough cutting operations, the hub is sent to the heat treating department where it is heat-treated to bring it up to the proper strength. It is after this operation that all the finished machining is done. This finishing includes splining the hub which is done with a Lapoint broach which is pulled through the hub by a hydraulic mechanism. Other interesting points of the finished machining are the grinding of the cone seats, the inside diameter of the face of the blade barrel, and the face of the hub which is done in order that the necessary close tolerances can be held. For instance, a tolerance of plus or minus five-tenths of one-thousandth of an inch is allowed for the inside diameter of the hub barrel. After these finishing operations are completed, a Leland Gifford drilling machine (with hydraulic feeding mechanisms) are used for accurate drilling of the small holes in the hub. The drilling of these holes must be extremely accurate as to alignment so when the hub is assembled with the rest of the propeller every unit will fit perfectly. Following this, the hub is polished and sent to the inspection department and from there to the Finished Stores.

The hub department is located on the opposite side of the center aisle, which runs the complete length of the plant, from the blade department (see Fig. 12). The head of the hub department is approximately opposite the rough stores department and from there the production line proceeds down to the point where the hub is finished and is turned directly over to the central inspection department.

This production line is well laid out so that a smooth flow of material from start to finish is able to be maintained.

(Continued in an early issue)

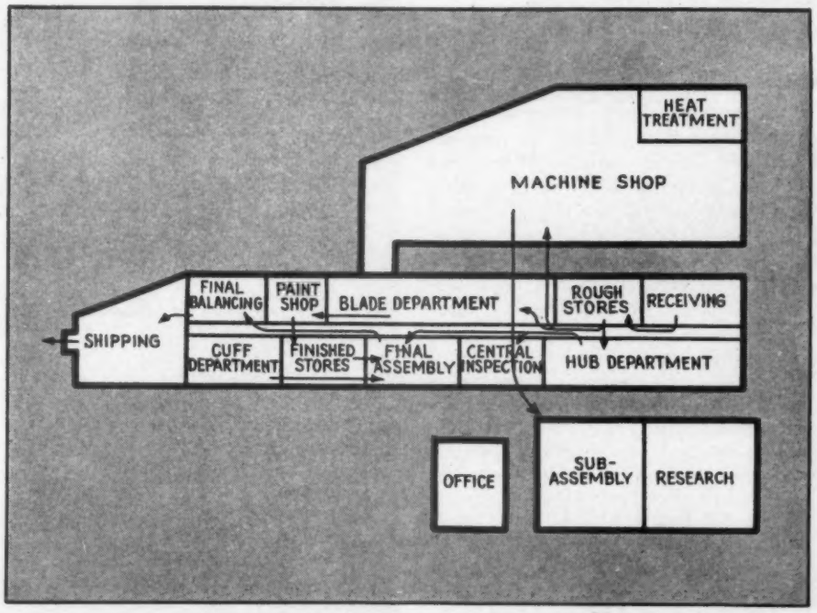


Fig. 12. The flow of production through the plant begins at the right end and travels through inspection to shipping, which is located at the left end (see Figure 13).

Fig. 13. Propeller shipping boxes in course of fabrication.

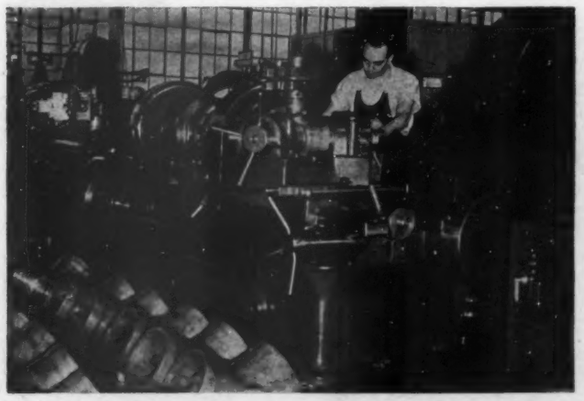


Fig. 14. Hall Planetary machining steel hub barrel.

Warplane Factories In Germany . . . Part 1

Fuselage assembly line in a Henschel factory showing He 126 observation planes under construction. At the far end of the line the B.M.W. 132 radials are being mounted in the airframes (right).

European

THE warplane industry in Germany has attained such enormous proportions that it is difficult to visualize it in the United States. Where we think in hundreds, the Germans think in thousands of warplanes and a yearly production of 18,000 warplanes is mere child's play for them. From what the writer saw when he visited their factories last year Germany has a capacity of 50,000 warplanes a year right now without expanding existing facilities. These factories are not working at maximum capacity but only produce replacements and reserve planes and engines for the vast air fleets. Should the need arise, the tremendous production facilities of these factories can be thrown into high gear immediately with unlimited supplies of material and trained personnel at their command.

Warplane production factories in Germany differ widely from those to which we are accustomed in the United States. Here we have slavishly copied automobile factories with practically all of the departments under one roof. As a result, our warplane factories constitute inviting targets which could be completely destroyed from the air. Needless to say, we have not provided air raid shelters for our employees or proper anti-aircraft protection for our factories despite the national emergency which we are told exists.

In Germany, each warplane production factory is a self-contained unit comprising numerous buildings spread over a large area, often camouflaged with trees. Workshops are kept to one-story height whenever possible to avoid casting shadows and specially constructed anti-aircraft gun platforms and guns are provided on the roof. Subterranean air-raid shelters with adequate ventilating and provisioning systems are located near the buildings to accommodate all the employees deep in the bowels of the earth.

When one obtains permission to visit a warplane factory in Germany, one is usually taken to the main factory where only development work and small series production is carried on. Small series production means from a few hundred to a thousand or more warplanes a year and is considered negligible. Real mass production of warplanes by the thousands and tens of thousands takes place in special *production* factories in different parts of the country so arranged that damage to one or more of them will not appreciably affect the output.

With the exception of Junkers, none of the German warplane factories build their own engines. Engine production has been standardized and only the very minimum of types and models are turned out. The entire German Air Force is built around three gasoline engines—the 1,200 hp. Junkers Jumo 211, the 1,200 hp. Mercedes-Benz DB 601 and the 1,000 hp. B.M.W. 132. In addition, thousands of Junkers Jumo

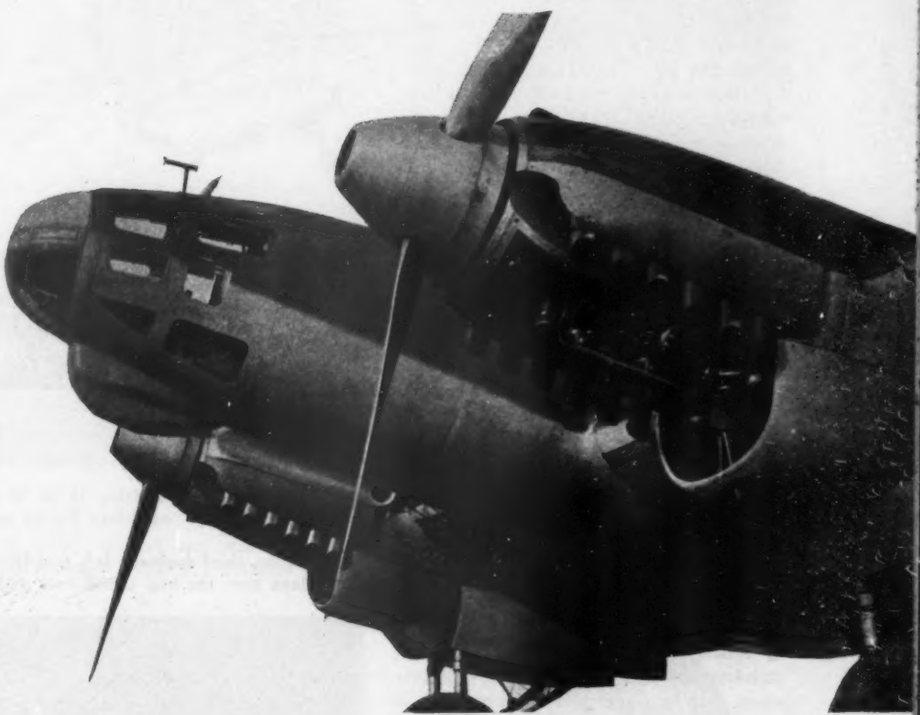
By Paul H. Wilkinson

Consultant, Diesel Aviation

Section of final assembly lines in a Messerschmidt factory showing Me 109 single-seater fighters under construction. The cantilever engine mounts are in the form of a one-piece forging.

Fuselage nose and engine nacelles of a Dornier Do 215 high-speed bomber powered with Mercedes-Benz DB 601 inverted vee-type engines. The accessibility of the fuel injection system is noteworthy (center right).

Both men and women are employed in aircraft factories in Germany. Here a mixed team is putting the finishing touches to a Mercedes-Benz DB 601 engine installation in a Messerschmidt Me 109 fighter (below right). Notice there is ample working room.



Diesels of from 700 hp. to 1,500 hp. have been produced for a special long-range bombing fleet. Aircraft engines in Germany are built along mass production lines similar to those used for airframes and the engine factories can supply the needs for 50,000 warplanes a year.

Heinkel He 111 twin-engined bombers are one of the best known German warplanes and many thousands of them are in commission. These planes are built by flow-line production methods at Oranienburg and elsewhere on a big scale. The latest Heinkel bombers have a speed in excess of 300 m.p.h. with full load and should not be confused with the older models used during the earlier stages of the European war. In addition to these warplanes considerable quantities of He 112 single-seater fighters having a speed of approximately 375 m.p.h. are beginning to make their appearance armed with two shell guns and a number of machine guns.

Friendly rivalry has existed between the designers of fighting planes in Germany and the firms of Heinkel and Messerschmidt have each in turn held the world's speed record. In March, 1939, a Heinkel He 112-U fighter was flown at a speed of 463.9 m.p.h. only

(*Turn to page 132*)

European

The Pitcairn WHIRL WING

The new "jump" autogyro designed by Pitcairn has been a big step in rotary wing aircraft, and its roadability feature should be of great interest to the commercial operator.

By Agnew E. Larsen, *Chief Engineer and General Manager, The Pitcairn Autogyro Corp.*

The Whirl Wing is capable of a vertical ascent from the ground of from 15 to 35 ft., depending on conditions of the wind, from which point it "takes-off" as shown by the path of the dotted line.

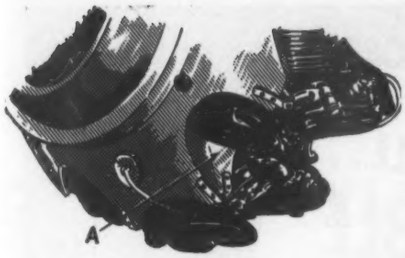
THE recently-announced Pitcairn Whirl Wing Autogyro is an outstanding development in the field of aviation. It is a completely new ship in every sense of the word, and its unique performance offers unlimited possibilities in the fields of civil, commercial and military aviation.

The engineering and experimental work that preceded the actual design and construction of this ship, reaches back through seven years. Studies were made in this country, and by the Cierva Autogyro Co. in England, of all available practical as well as experimental data. The aims were set at developing an autogyro which had the safe flying and slow landing characteristics, and to incorporate the direct or "jump" take-off characteristics which have been under development since 1933.

In the preliminary studies for the design of the Whirl Wing, full consideration was given to where the motor should be located. The advantages and disadvantages of placing of the motor in the nose of the ship or in the center of the ship were carefully weighed. The facts pointed strongly towards the mid-ship location.

The advantages gained by enclosing the motor within the fuselage, back of the pilot's seat, are numerous. First, the substantial increase in the range of vision for both pilot and passenger were of major importance. Second, the fact the power to drive the rotor-starting shaft could be taken from the proper side (the front) of the engine, permitted the unlimited use of the available horsepower for bringing the rotor up to speed. Third, the forced-draft cooling of the engine could be controlled under all conditions. This third point has several other interesting angles worthy of mention. Because the autogyro can and does maintain flight at low speeds, the motors on previous ships, where cooling depended on the air speed, frequently overheated. In the Whirl Wing, the use of a drive shaft from motor

A. E. Larsen, chief engineer, left, and Harold F. Pitcairn, president, of the Pitcairn Autogyro Corp., look over the hub of the new ship.

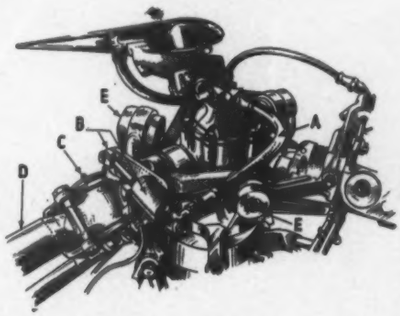


In the cooling system, the air, after passing through a flywheel-fan is guided, by means of carefully designed baffle plates "A" around each cylinder head and barrel.

to transmission required the installation of a fly wheel to remove any tendency towards torsional vibration in the shaft. This fly wheel was designed with an integral Sirroco fan around its perimeter for forcing the air through the cooling system. It also incorporates a ring gear which makes possible the use of a standard automotive-type electric starter.

In this new cooling system, air is drawn in through a grill located in a high-pressure area on the nose of the ship. The air is carried through a duct, which passes under the floor and seats, to the fan housing. There is a small radiator in this duct which cools the oil for the transmission unit in the nose of the ship. After passing through the flywheel-fan, the air is guided, by means of carefully designed baffle plates, around each cylinder head and barrel. A second oil cooling radiator is located in the cold air stream for cooling the engine oil. After the air has passed the engine it goes into the rear of the fuselage, and outlets that were carefully located so as to be in points of negative pressure, provide means of exhausting the heated air from the ship with a minimum of power consumption.

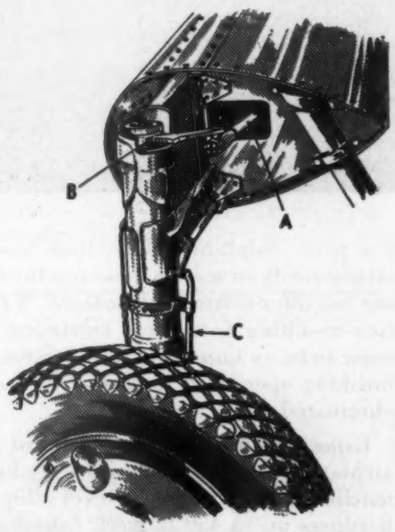
Of the many operating features of the new Pitcairn Whirl Wing, the most important is its method of take-off. The preliminary ground run has been completely eliminated. From a locked-wheel position it actually jumps vertically into the air and swings smoothly into forward flight. The height of this vertical take-off varies from 15 ft. in still air to about 35 ft. under moderate wind conditions. This ability to takeoff without any ground run whatsoever not only enables this ship to clear hedges, fences, and similar obstacles, but also permits it to take off from rough or broken-surfaced terrain.



The rotor blade is attached to the hub through two hinges "E". The hydraulic line "A" forces oil into the cylinder "B" moving the piston which is connected to an arm on the blade. This controls the pitch of the blade. "C" is a hinge allowing the blades to move up and down in the horizontal plane. "D" is the arm connecting the blade and hub.

Before commenting on any of the other advantages and improvements incorporated in this new ship, a brief explanation of the principles on which this jump take-off operates, may well be given. These principles are relatively simple. The rotor, which furnishes all the lifting force in the autogyro type of aircraft, has three blades that are threaded into the rotor-hub with high-pitch threads. A short lever arm is fastened to each rotor-spar just outside of the threaded connection and small hydraulic cylinders are located so that the pistons they contain bear against the small lever arms on the spars. When hydraulic pressure is applied to these three cylinders, the pistons are forced out against the lever arms which turn the threaded blade connections into the rotor hub. Stops are provided so that, with the pressure applied, the screwed-in blade spar connections hold all rotor blades at the flat or zero lift position. While the blades are in this position, the rotor can, by means of the rotor drive mechanism, be accelerated to 300 r.p.m. while the ship is standing on the ground. Releasing the pressure in these cylinders permits the blades immediately to "unscrew" the few degrees necessary for the blades to obtain normal flight pitch. Since normal flight rotation of the rotor is only 180 r.p.m.,

(Turn to page 131)



One of the roadability features requires a steerable landing gear. This is accomplished through a system of tie-rods and bellcranks. Tie-rod "A", connected to the control wheel turns bellcrank "B". "C" is the hydraulic line to the brake.

The compact width of the autogyro is shown in its unique landing gear and tail arrangement. With the engine in the rear, behind the louvres, excellent visibility is obtained from the cabin. Air scoop is below the propeller.

NICKEL ALLOY STEELS

For parts which must have high hardness to perform satisfactorily in service, heat treatment *before* machining can offer distinct advantages. Warpage and distortion resulting from heat treatment after machining cease to be an important factor. Straightening or other finishing operations to correct for such distortion are eliminated.

Especially interesting are present shop practices of airplane part and other mass production plants now machining heat treated Nickel alloy steels ranging in hardness up to 450 Brinell. *(above)* Stressed Hydromatic Propeller spiders of SAE 4340 heat treated to approximately 415 Brinell are machined with ease on a Bullard Mult-Au-Matic in the regular production line at the East Hartford, Conn. plant of Hamilton Standard Propellers, Division of United Aircraft Corp.

• • •

In a recent demonstration on a standard Warner & Swasey turret lathe conventional high speed tools readily turned, chamfered and drilled a 2″ bar of Nickel-chromium-molybdenum steel at a hardness of 450 Brinell. The turning cut was fed at .012″ at a speed of 42′ a minute. The close helical chip showed no tendency to tear, check or burn. The smooth surface produced indicates that machining Nickel alloy steels at high hardness is not unusually difficult.

Hamilton Standard Propellers, Division of United Aircraft Corp., East Hartford, Conn. regularly machine SAE 4340 stressed Hydromatic Propeller parts including spiders, illustrated here, and cams after they have been heat treated to approximately 415 Brinell. Hard Nickel alloy steels are no hazard where machining is concerned. For additional information please write to the address printed below:

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

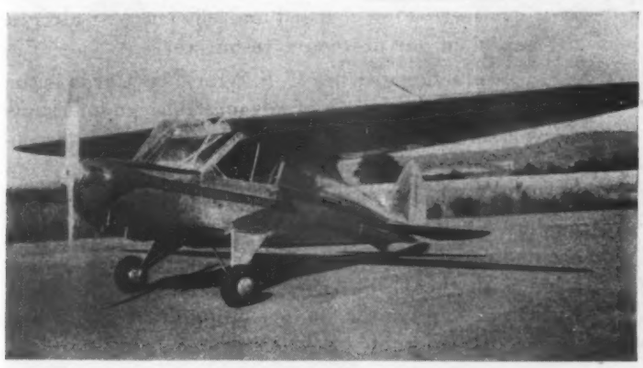
Grumman "Widgeon"

TO CARRY a pilot and three passengers plus baggage non-stop from New York to Chicago at 150 m.p.h., is a pretty good job for any private owner plane. But when such performance can be obtained from a small amphibian, it's really worth sitting up and looking at. This month out of the doors of the Grumman Aircraft factory will roll just such a ship.

The new "Widgeon" is a four-place amphibian that has been built specifically for the private owner market. With this in view, the operations of the plane have been greatly simplified and is almost freed of gadgets that must be manipulated. The amphibian is a twin-engine ship powered with two Ranger motors of 200 hp. each. With a cruising speed of 150 m.p.h. and 100 gal. fuel capacity, fully loaded, the cruising range is 750 miles. From all reports, the single engine performance has shown up very well, and the ship can be flown "hands off", with either engine inoperative.

The construction is of typical Grumman design and does not look a great deal unlike the familiar Grumman "G-21A". The wing consists of a single large box spar with two integral fuel tanks of 50 gal. capacity, each located in the center section directly behind each power unit. The outer wing panels join the center section just outboard of the engine nacelles, and aft of the spar are fabric covered to facilitate inspection. For the same reason all control surfaces are fabric covered. The hull is divided into three watertight compartments comprising the bow compartment with a hatch to aid in mooring and docking, the center cabin which is fitted with large Plexiglass windshield and windows, and the tail cone which is easily accessible from the outside as well as the inside. The passenger cabin is fitted with four chairs for the pilot and three passengers, and in addition there is an auxiliary seat for a fourth passenger for commuting and other short haul flights.

The designers of the amphibian were careful to obtain the utmost simplicity of flight control. To obtain this a wing loading of 17 lb. per sq.ft. was used which improves landing characteristics on both land and water. The pure trailing edge flap also enhances the landing characteristics. The low bow was designed to prevent nosing over on land and gives some of the characteristics of a tricycle landing gear, while the wide tread of the wheels makes cross-wind landings and tackings much easier. On the water the ship is reported to be firm laterally and can be turned so sharply that the inside wing tip moves backwards.

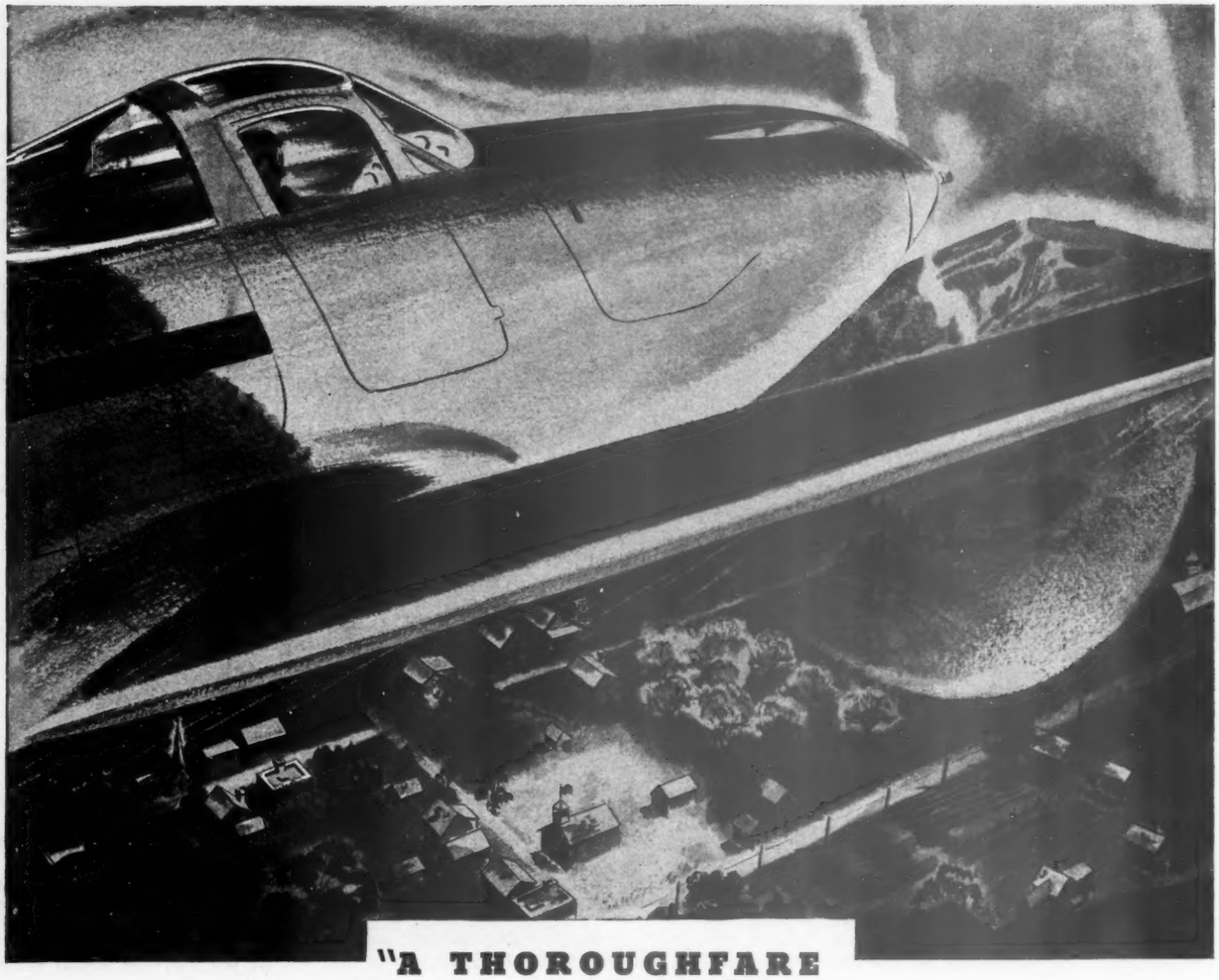


New All-Metal Light Plane

WITH a top speed of approximately 130 m.p.h. from a Lycoming 75 hp. motor, a new all-metal ship, manufactured by the Naugle Aircraft Corp., has entered the light plane field. The new plane has recently completed its first flight test which has shown some very interesting results. A few of the performance figures obtained from these tests were a landing speed of from 40 to 42 m.p.h., without flaps, and a climb of 1,000 ft. per min. for 1,500 ft. with the pilot the only occupant of the ship.

The test flights were made with a plane having a fixed landing gear and without flaps. Experiments are being carried out on the use of flaps which is expected to greatly reduce the landing speed. Also a retractable landing gear is being designed and from the test data so far available the top speed of the plane is expected to be about 150 m.p.h. and the landing speed to be about 40 m.p.h.

Details of the new plane so far are witheld. The fuselage is of stressed skin construction with a large windshield giving excellent visibility. The wings are of a special design being cloth-covered. A Sensenich propeller is used and the hydraulic brakes are manufactured by Shinn Devices. Production plans are under way.



"A THOROUGHFARE FOR FREEDOM BEAT"

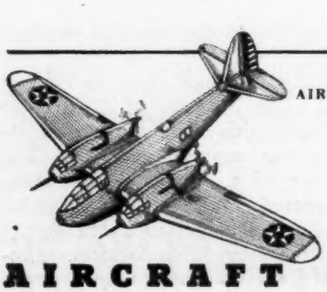
Day by day, almost hour by hour, America becomes to each one of us a dearer land. Pulses beat faster. Emotions are quickened. More and more poignantly we feel that from sea to shining sea, *this is our land.* Our land to love, and when the need comes, to defend.

No proud isolation guards our shores. Mere miles offer us no security. Clearly we see today that the barrier around America will henceforth be in its entirety the product of our own zealous handiwork.

In this country's program of protection the name Bell Aircraft assumes an ever-increasing significance. In countless ways Bell is cooperating with the nation's pilots in advancing the design, speed and efficiency of aircraft to strengthen our protective resources.

In production for the U. S. Army Air Corps is the Bell Airacobra. A plane of advanced design and superior performance, its mission is the effective interception and attack of hostile aircraft.

At Bell Aircraft, every idea, every tool of our ultra-modern plant is devoted to the ideal of defense. We are dedicated to the proposition of continued cooperation with the U. S. Army Air Corps and the Navy Bureau of Aeronautics in developing the most efficient means of preserving America, a free land, inviolate.



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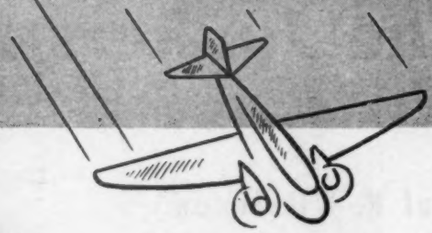

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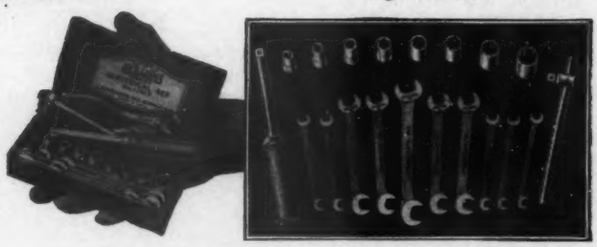
SET 6

10 strong, thin-wall "Supersockets" and 9 drives in the Bantam Pattern (⅜" square drive). Very practical for a wide variety of aircraft service operations, and especially for work in close quarters. 12-point openings, ¼ to ¾".



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These tools are typical of the expert design of all WILLIAMS "Superrenches." Slender and thin, they're meant to work fast in close quarters. Both openings are the same size. Where one won't work, the other will. Available in 13 sizes.

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SUPERSOCKETS - SUPERRENCHES

The Junkers JUMO 211

By Paul H. Wilkinson
Consultant, Diesel Aviation

Here is a description of the twelve-hundred horsepower Junkers Jumo 211 aircraft engine now being used in the Stuka dive-bombers by the German Air force.

THE extensive use which is being made of thousands of Stuka (Junkers Ju 87) dive bombers by the German Air Force in the European war focuses attention on the power plants with which these warplanes are equipped. That they are all equipped with the same type of engine goes without saying inasmuch as standardization is one of the essentials of military equipment in Germany. Junkers Jumo 211 engines are also used in high-speed Junkers Ju 88 bombers and they have been installed in Heinkel bombers and fighters to an appreciable extent. Primarily, one associates the Jumo 211 with the Stuka and it must be admitted that the two make a very effective combination.

The basic requirements insisted upon when the Jumo 211 was designed were high power output at ground level and altitude, low weight, compactness, economical fuel consumption and maximum reliability. That all of these requirements have been combined in one engine is quite an achievement and is due to the wide experience which Junkers have had with water-cooled power plants. High power output is obtained by means of a two-speed supercharger, low weight is made possible by refinement of design, compactness is obtained by building the engine with its cylinders in an inverted vee, economical fuel consumption is obtained by means of direct fuel injection, and reliability is ensured by exercising the most rigid inspection control during the process of manufacture.

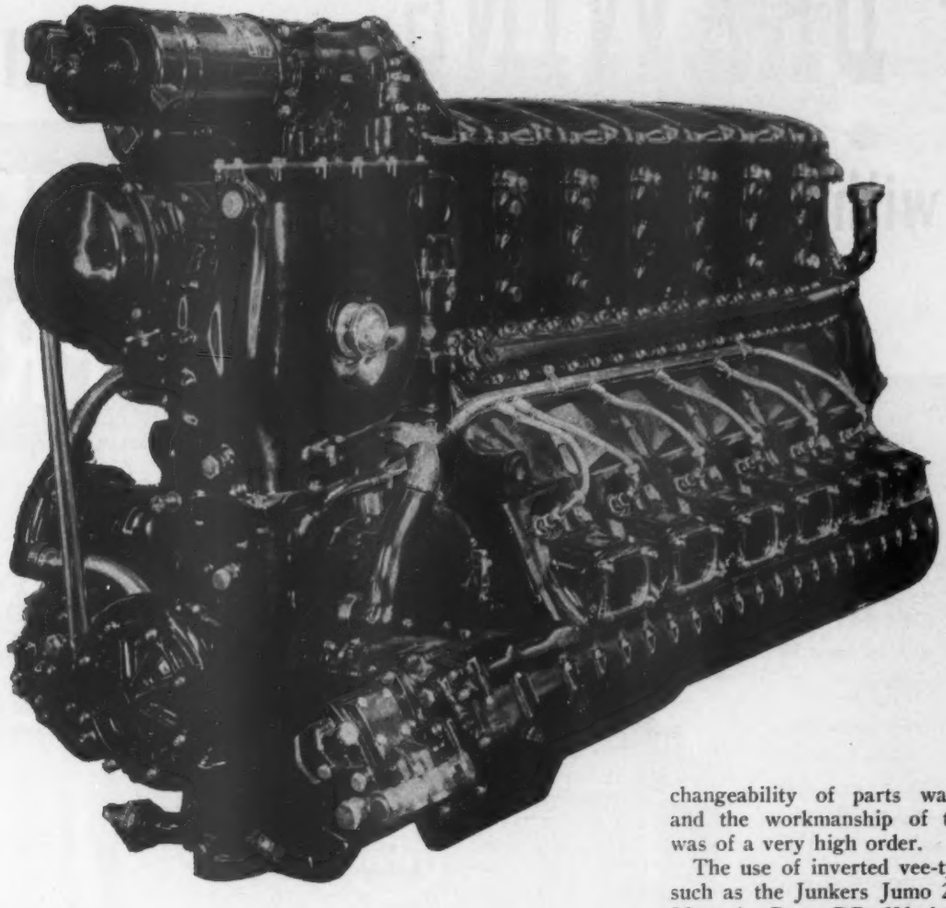
When the Jumo 211 was first produced in quantity in 1938, it was rated at 1,025 hp. at 5,600 ft. and 975 hp. at 13,800 ft., with 1,000 hp. available for take-off. Since that time its performance has been considerably improved so that now it has a rating of 1,200 hp. at 6,500 ft. and 1,000 hp. at 16,400 ft. and develops 1,200 hp. for take-off. The weight of the engine is 1,290 lb. and its specific weight is 1.07 lb. per hp. These power outputs are obtained with 87-octane gasoline.

Apart from its inverted cylinder construction, the Jumo 211 follows conventional practice. The crankcase and cylinder blocks are a one-piece casting of aluminum alloy with the blocks set at an angle of 60 degrees. The crankshaft is of twelve-throw construction with counterbalances and is supported in seven main bearings. On the front end of the crankshaft there is a spline-mounted spur wheel which drives a spur gear wheel on the propeller shaft and provides a reduction ratio of 1.55 to 1. At the rear end of the crankshaft there is a tail-shaft from which drives are taken for the supercharger and the electric generator mounted on top of the crankcase. A spur gear wheel is also provided at the rear of the crankshaft from which a gear train extends down to the two camshafts, the oil pumps, the centrifugal water pump and various small accessories.

The valve mechanism is operated by means of an overhead camshaft along each cylinder head and two inlet valves and one exhaust valve are provided for each cylinder. The pistons are fitted with three pressure rings above the piston pin and one oil scraper ring below it. The connecting rods are machined from I-section steel forgings and have big-end bearings of unusually large area. The propeller shaft is hollow so that a shell gun can be fired through it and it is made with a large flange with serrated teeth and holes for eight bolts for attaching the propeller in accordance with German standards. The propeller reduction gear has an efficiency of from 98 to 99 percent.

Instead of the down-draft carburetor usually found on high-performance aircraft engines, the Jumo 211 is equipped with a twelve-unit high-pressure injection pump which injects the gasoline direct into each cylinder where it forms the correct mixture with the air forced into the cylinder by the supercharger during the suction stroke. Fuel injection is used on many of the military aircraft engines in Germany and has the advantage that there is no danger of engine stoppage after a power dive or during aerobatic maneuvers. It also makes the engine less fuel-sensitive and permits a slightly lower grade of fuel to be used without impairing the performance of the engine.

The two-speed supercharger is mounted so that the axis of its impeller is at right angles to the crankshaft of the engine instead of parallel with it as in most installations. The impeller is of the high-speed closed type and sucks in the air through curved vanes around its hub and discharges it at high velocity through openings around its periphery. The altitude control is in the form of a capsule or metal sylphon controlled by atmospheric pressure which transmits its expansion and contraction to a small hydraulic servo-unit which opens and closes the throttle valve in the air intake of the supercharger. At high altitudes the capsule expands due to the reduced atmospheric pressure and this causes the servo-unit to increase the opening of the air throttle valve. The fuel consumption of the engine is approximately 0.45 lb. per hp. per hr. when it is cruising at an output of 900 hp.



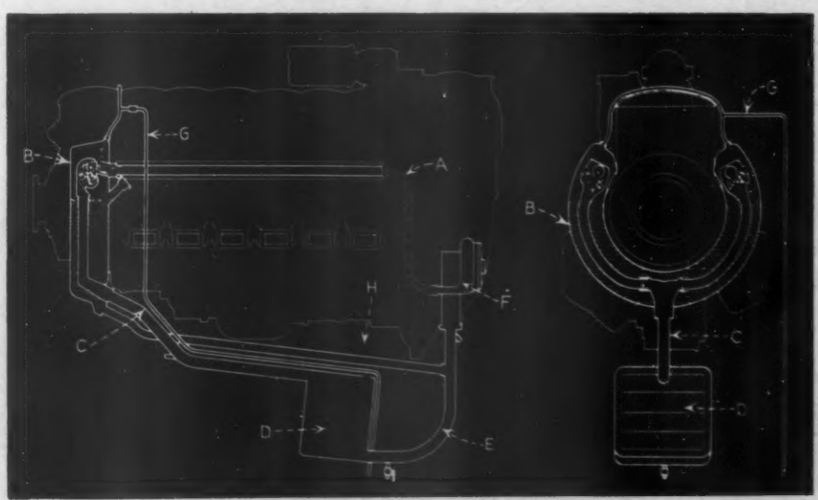
The lubrication system functions on the dry sump principle with one pressure feed and two scavenger pumps of the rotary gear type. The oil pressure ranges from 60 to 90 lb. per sq.in. Water is used as the coolant and is circulated by a centrifugal pump with a circular header tank around the front part of the engine. The use of water as a coolant instead of ethylene glycol which is used in most liquid-cooled engines enables the Jumo 211 to be serviced quickly wherever it may be without requiring supplies of a special coolant. Drives are provided for an electric generator, an air compressor or vacuum pump, a shaft-driven and an electric tachometer and two machine gun synchronizers.

When the writer saw the Jumo 211 in mass production in the Junkers factories in Germany last year it was particularly noticable that rigid inspection control was maintained during all stages of manufacture. Even the crankcase castings were tested with Rontgen rays to ensure that the material was satisfactory and the rontgenographs of each casting were filed away for future reference. Much of the inspection work on small precision parts was carried out in air-conditioned rooms with up-to-date electrical and optical apparatus. Complete assemblies such as pumps and superchargers were tested and calibrated on special testing machines before assembly on the engines. Interchangeability of parts was excellent and the workmanship of the engines was of a very high order.

The use of inverted vee-type engines such as the Junkers Jumo 211 and the Mercedes-Benz DB 601 for high-performance warplanes in Germany is in sharp contrast to the use of upright vee-type engines such as those used in the United States and the Rolls-Royce

(*Turn to page 132*)

Diagram of closed-circuit water cooling system of Junkers "Jumo" 211 gasoline aircraft engine.
The following quotation corresponds to the lettering on the drawing: A—point where coolant enters cylinder block; B—header tank; C—radiator return pipe; D—radiator; E—connection to coolant pump; F—coolant pump; G—steam vent; H—overflow return pipe.



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The Culver Cadet

THE Culver Cadet's range of 600 miles and guaranteed cruising speed of 120 m.p.h. is aimed at opening up many new flying possibilities for the private pilot. Many comparatively new features for lightplanes are incorporated in the design of this ship, one of the main ones being the retractable landing gear which enables the plane to attain a speed of 140 m.p.h. A slotted wing is also incorporated which provides better lateral control at low speed and increases the ease of landing.

The Model L-CA is a two-place, low-wing monoplane powered by a Continental four-cylinder air-cooled motor rated at 75 hp. The fuselage is of semi-monocoque construction with a stressed skin covering of reinforced plastic-type material. The cockpit is inclosed by Pyralin and doors are provided on either side of the cabin. Doors open forward and permit entrance or exit over the wing root. The seating arrangement is side-by-side and dual stick controls are provided.

The wing structure is of the mono-spar type, the main shear spar being of compressed plywood and spruce construction to take the entire bending moment and shear resulting from the air loads. The wing torsion is transmitted to the fuselage fittings by means of a chrome molybdenum steel torsion truss which is located between the main shear spar and the rear auxiliary spar. The wing is of the full cantilever type, with the three low-drag slots located near the wing tip. The leading edge of the wing, in front of the main spar, is of plywood construction, and the whole wing is fabric-covered. The ribs are of wood construction. The tail section is a cantilever type, utilizing a continuous elevator provided with a trimming tab.

The retraction of the landing gear is accomplished by means of a mechanical operation through a wheel located in the cockpit between the two occupants. Two turns of this wheel will retract or lower the gear. In its retracted position, each of the individual legs of the gear is fully inclosed by a fairing.

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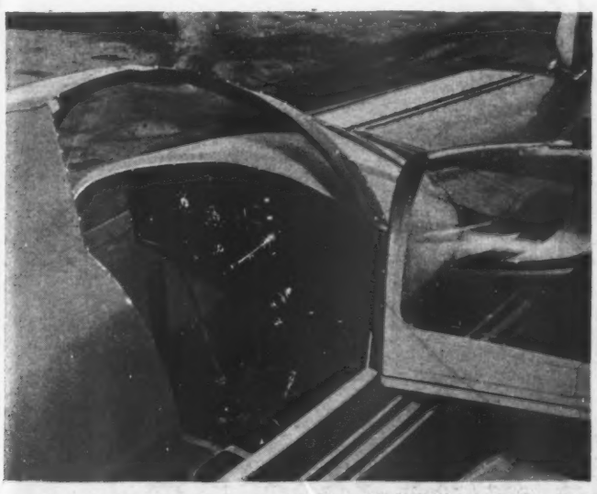
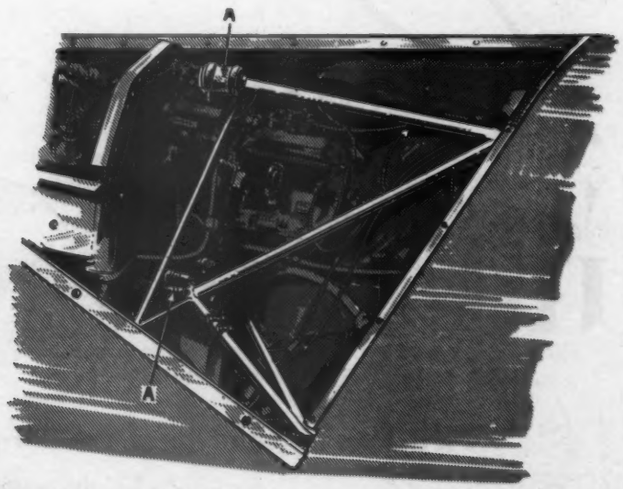
Flying EQUIPMENT



The cabin of the Culver Cadet has ample room for both pilot and passenger. Instruments are placed so as to be easily read by the pilot. Access is through a door extending partway into the roof with sides molded of Pyralin.



The engine mount suspends the motor by vibration mountings "A". The heavy tubes taking the loads extend back to fittings in the fuselage while the side members support the cowl of the plane, giving easy motor accessibility.

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Aviation's Potential Profitless Prosperity

By Selig Altschul

COME what may, it is well established that the aircraft industry will not want for lack of business in the immediate future. Less certain, however, is what profit margins, if any, may prevail in the industry. It is this unknown element that has caused investors to view aircraft securities with a quizical eye in an attempt to appraise all possible factors.

The excess profits tax bill resulting from a compromise between the suggestions of the Treasury and of the joint congressional committee, may at least clarify major uncertainties facing the aircraft industry.

Encouraging is the provision calling for the suspension of the Vinson-Trammell Act profit restrictions on ships and aircraft contracts. This Act has long served to discriminate against shipyards and aircraft builders. The proposed excess profits tax would tend to equalize treatment accorded all companies manufacturing for the national defense program.

An important forward step is the special amortization plan for defense plant expansions. It is proposed to allow those industries which have expanded their plants and acquired new equipment since July 10, (the date of the President's defense message), to amortize the cost of the expansion over a five-year period or even a shorter period of time if the emergency ends within five years.

The excess profits tax provisions proper, holds promise of providing many a headache to corporate executives and accountants. Under the proposal, a company has the option of calculating its excess profits tax exemption, either on the basis of its average earnings for the years 1936 to 1939 inclusive or on the basis of average return on invested capital in those years. Under both options the excess profits tax rates are the same.

The invested capital provisions of the tax schedules of the last war raised lengthy and involved questions which were not settled for years. Apparently this provision is again included in an attempt to mitigate, for those companies whose profits in recent years have been sub-normal, the severity of a levy based solely upon average profits for the designated base years.

The excess profits tax bill as it now stands would severely affect the aircraft companies. Generally speaking, the aircraft builders expanded rapidly during the base period designated, with earnings attaining a sharp peak in 1939. Moreover, as yet the industry has been unable to have developed invested capital to the extent where it could obtain sufficient exemptions to permit any important retention of earnings. Unofficial estimates have indicated that in the case of certain major aircraft builders, profits before taxes would need to be approximately one-third larger than last year in order to finish with the same net profit.

Inasmuch as representative companies for 1940, are on their way to at least double last year's profits on a normal basis, the new excess profits tax bill does not appear too abortive. While the government would obtain a substantial share of the increase in corporate profits, the aircraft manufacturers would not be prevented from making money.

As aircraft securities have never fully discounted the lush profit estimates anticipated early this year, they are now less susceptible to any drastic market shakeout. In fact, even after consideration of the drastic effect the new tax law may exert on earnings, the estimates are such that leading aircraft equities continue to sell at a low ratio in relation to anticipated earnings after all tax deductions.

Less fortunate is the air transport industry in its status under the proposed excess profits tax bill. This growing industry did not have its first profitable year until 1939. Using the 1936-1939 period as an average, it is found that the industry as a whole, was hopelessly in the red. Obviously this is a very unsatisfactory base from which to predicate exemptions under the tax bill. Applying the invested capital option, it is found that the airlines are equally in a bad way. Total assets for the industry amounted to only about $47,000,000 as of last year-end. With substantial plane acquisitions constantly being made, the airlines have need to retain their earnings in order to help pay for such purchases.

The Air Transport Association has recognized this problem and its president has asked for complete exemption for the airlines from the provisions of the pending bill. The contention has been advanced that as the earnings of most of the air carriers are regulated by the Civil Aeronautics Board, there is no need to apply the excess profits tax to this group.

With complete figures available for the air transport industry's record-breaking first half, proper interpretation of the relative accomplishments of the major lines becomes possible.

The growth factor continues to be very pronounced in the case of all companies and for the industry as a group. Table I shows the increases in terms of percentages only for the first six months of 1940 as compared to the like period in 1939. An examination of these figures clearly shows distinct trends for all of the individual companies presented and a significant pattern for the industry as a whole.

American and Eastern reflect the benefit of additional ships in service thus permitting more schedules, hence the largest increase in revenue-miles flown. Although United and TWA also augmented their fleets, it was to a lesser degree than American and Eastern.

The sharp increases in revenue-passenger-miles flown shown by both Penn-Central and Northwest, is primarily due to the replacement of smaller equipment by new 21-passenger DC 3's. The "big four" all improved their load factors thus showing an accelerated rate of increase in revenue-passenger-miles flown as contrasted with the improvement in revenue-miles flown. The installation of the "Stratoliners" in

(*Turn to page 131*)

TABLE I

Improvement in Airline Operations First Half of 1940 Compared to Like 1939 Period

	American %	Eastern %	Northwest %	Penn-Central %	TWA %	United %
Revenue - Miles Flown	42	42	17	19	33	30
Revenue - Passenger Miles Flown	62	58	75	76	58	60
Total Passenger Revenues	60	57	42	44	54	58
Total Mail Revenues	9	11	1	11	7	6
Total Express Revenues	19	35	29	42	39	18

AVERAGES

	Barron's Aircraft Average	Barron's Air Transport Average	Barron's 50 Stock Average
July 12	33.78	26.06	71
July 19	33.48	26.66	73
July 26	34.18	26.44	71
Oct. 2	35.72	26.97	74
Oct. 9	35.52	26.09	73

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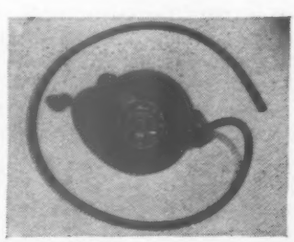
3-Position Switch selects either variable tuning or one of two pre-selected crystal-controlled frequencies, in this RCA AVR-20 Aircraft Receiver. 2300 to 6800 kcs. Accurate Reset. Easy Tuning.



Quickly released in flight—safely locked on the ground—this RCA AVA-41 Retractable Antenna affords high efficiency and low drag. New handle mechanism reduces hand operation by half.

Air force display at Donmuang airport showing a score of Siam's biplane fighters.

AVIATION MAKES PROGRESS IN SIAM

With World Politics focusing new attention in the Far East the aeronautical situation in Siam is of timely interest.

By Lucien Zacharoff *author of, "This is War!" Associate Editor, Aircraft Publications*

IT is sometimes difficult to realize to what extent this world of ours is in the grip of airmindedness, both in war and peace, unless one examines the aeronautic strides made in recent years in such small and out-of-the-way countries as Thailand—also known as the Kingdom of Thai—*Muang Thai* to its natives, and Siam to most foreigners.

To be sure, Thailand's commercial and military aeronautics are dwarfed alongside the aviation facilities and resources of the great American and European powers. However, the flying setup there is up to the minute and most impressive when one remembers the size of the little country and its inaccessible (or almost so) situation in technologically undeveloped Southeastern Asia.

A glance at the photographs illustrating this article will convey the idea that while Thailand, one of the last absolute monarchies, may not be the last word politically, it has kept up with the flying progress on this planet.

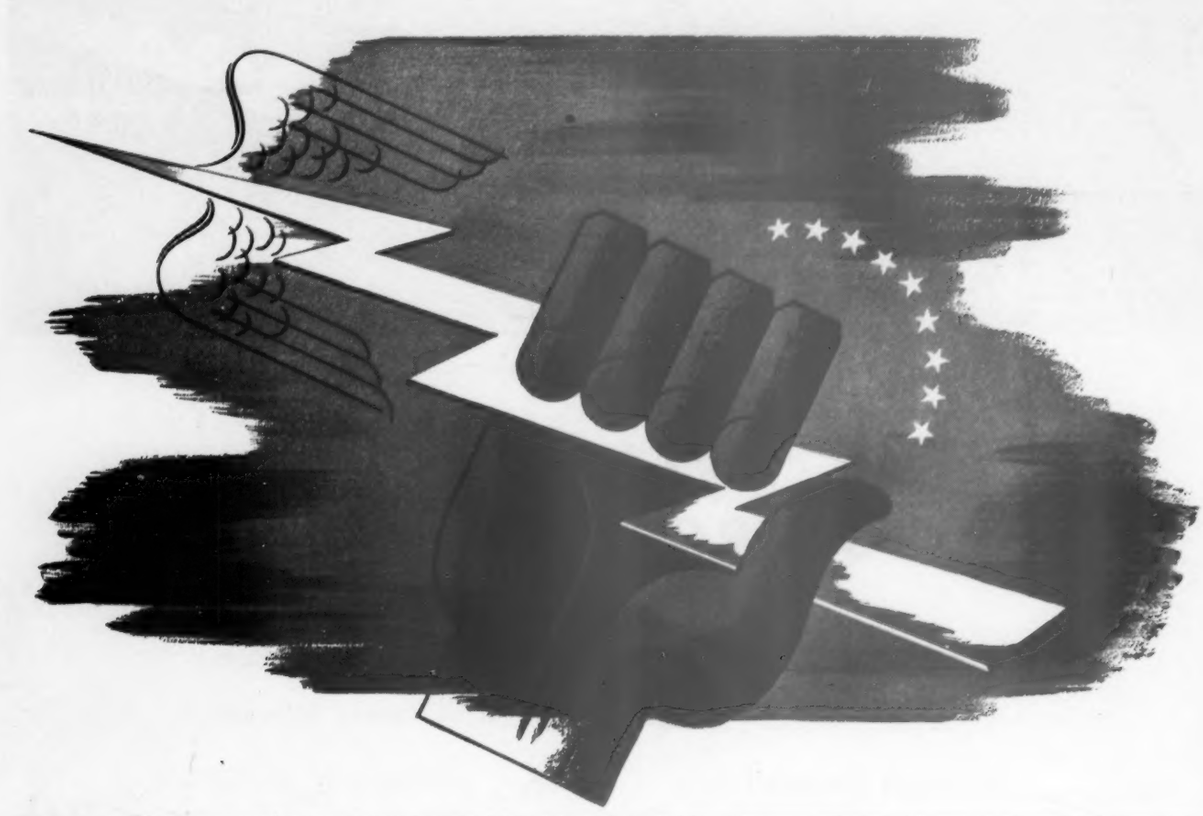
Since warfare or preparations for it pervade the atmosphere of all continents, let us first survey quickly the status of military aviation in the realm. Formerly known as the Royal Aeronautical Service, the Royal Air Force had been separated from the Army some time ago and is now under the direct operational command of the Minister of National Defense. Its Commander-in-Chief is Group Captain Phra Vejyant Rangsrisht.

Although there are no native aircraft manufacturers in Thailand and the Air Force depends on such importations as the Curtiss Hawk, Vought Corsair, Martin Bomber and Avro 504 N, there are military workshops building experi-

(*Turn to page 128*)

A battalion of tractor-drawn anti-aircraft guns at the Siamese capitol.

Photographs by Triangle Photo Service



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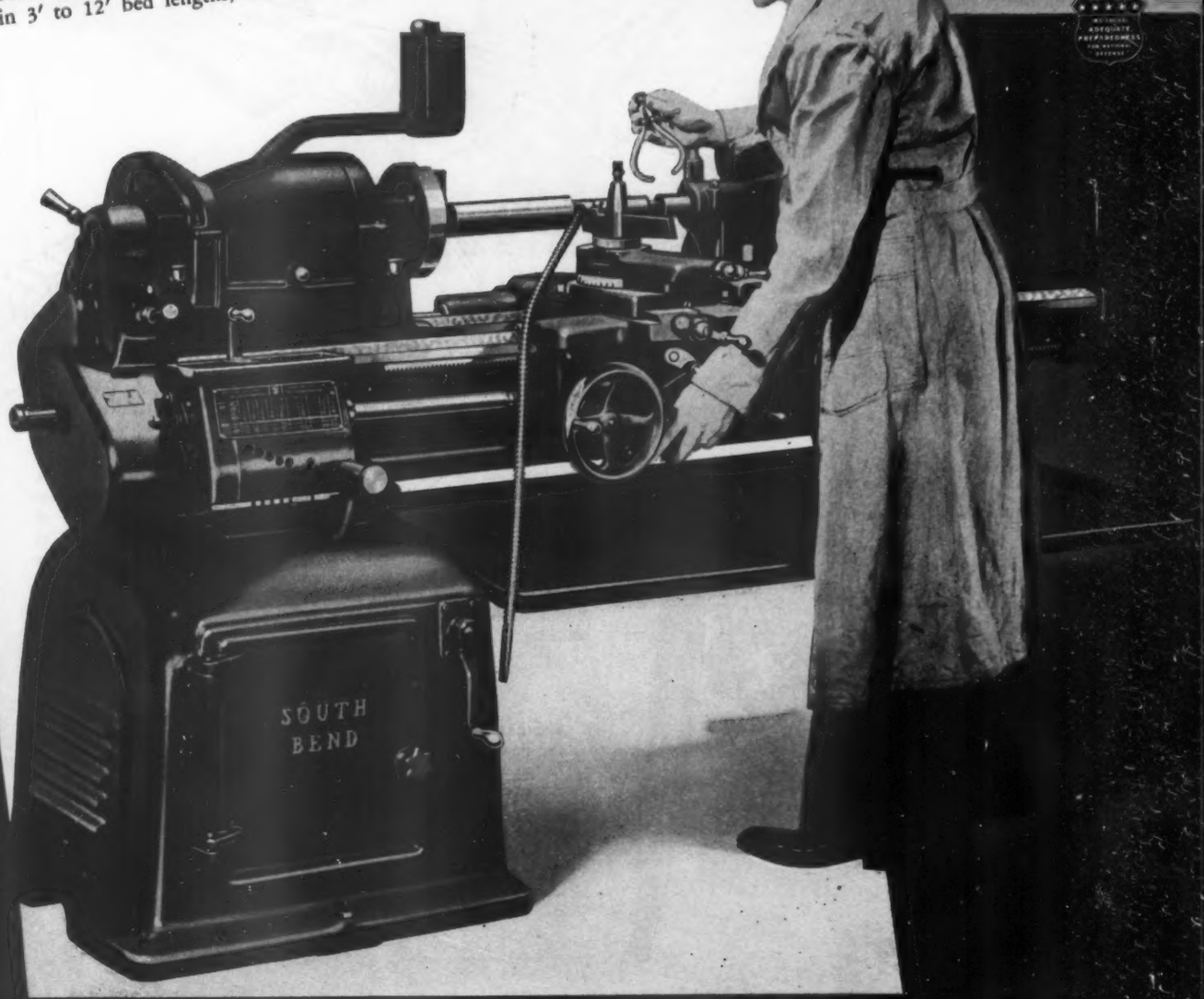
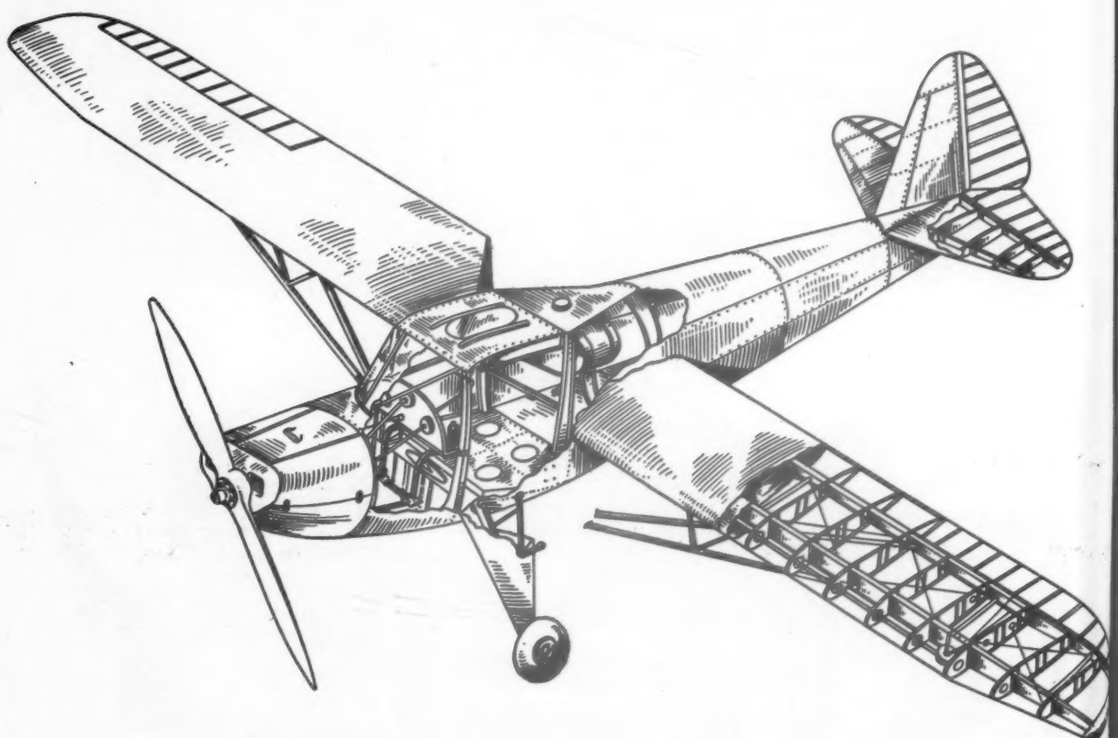


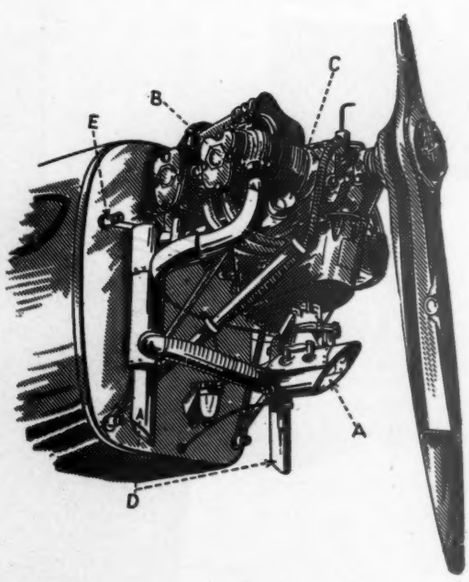
SOUTH BEND LATHE WORKS

LATHE BUILDERS SINCE 1906 — 181 E. Madison St. South Bend, Ind. U.S.A.

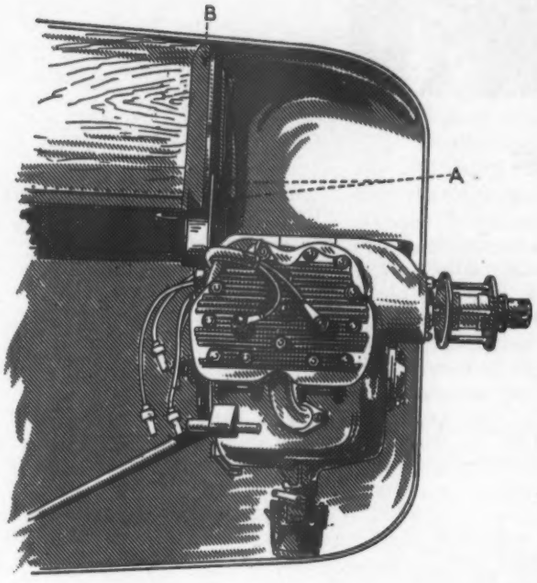
Aviation SKETCH BOOK of Design Detail

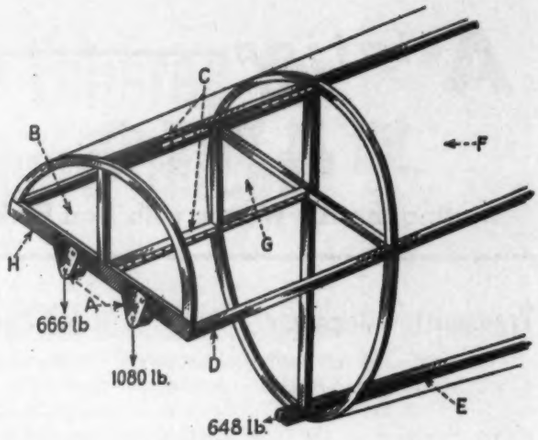


The fuselage of the Luscombe model 8A is of semi-monocoque stressed skin construction. It is built up of aluminum alloy sheet with aluminum alloy bulkheads. The fixed tail surfaces are of stressed skin construction also with metal ribs. Wings are of wooden spars and ribs with fabric covering. The control surfaces are manufactured by a special process that produces corrugations parallel to the slip stream, and are of metal construction. The roof of the cabin has a skylight built in with the gas tank directly behind.



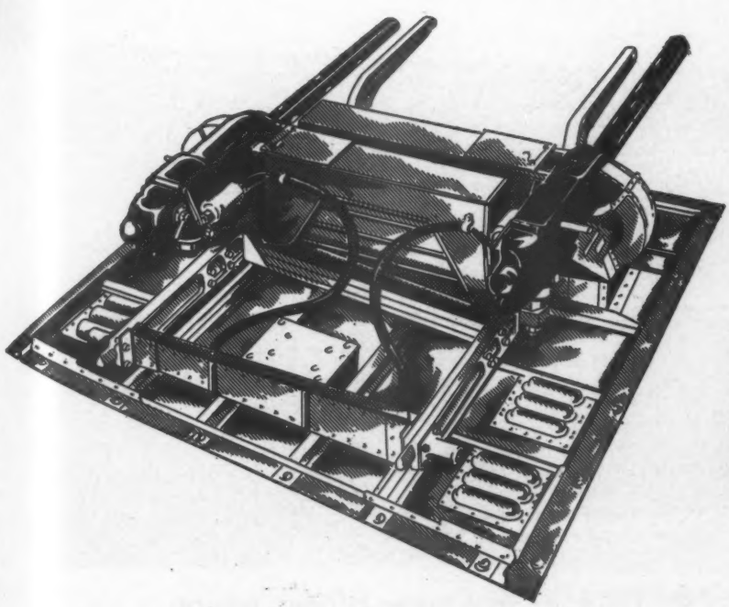
The new Aeronca models 50-TL and 65-TL have the new exhaust system shown at the left. "A" is the carburetor air inlet scoop which incorporates a valve that can be operated from the cabin. "B" is the exhaust manifold that connects to the exhaust tail pipes "D", and are welded directly to the tail pipes. "C" is the air inlet for the carburetor heater muff. "E" is one of four attachment bolts connecting the engine mount.





The engine mount of the Johansen JA-2 is made of bith metal and wood construction. The brackets "A" on the drawing at left and the above right suspend the engine from the semi-monocoque wooden construction and are designed to take the loads indicated. "B" is an end plate made up of 1/16 inch three ply material. "C" are two reinforcing members of 1 in. by 1¼ in. spruce. Supported on this is a 1/16 inch three ply mahogany panel on both sides "G". "H" is a 2¼ in. by ¾ in. spruce member and "E" is a 1¼ in. by 1¼ in. spruce member. "F" is 1/16 inch three ply material.

The pilot's seat designed and built by the Kellett Autogyro Corp., is of 24-ST Alclad construction spot welded. The seat can be adjusted vertically along the supports "B" and other adjustments by the handle "A." The angle of the back and bottom is 101 degrees. The seat has withstood a vertical downward load of 4000 lb. and one against the back of the seat of 1225 lb.



The fixed wing gun installation (left) of the Martin 167F Reconnaissance Bomber consists of two .30 caliber machine guns, cartridge boxes and firing solenoids. Guns fire through blast tubes running between front spar and leading edge, and the unit swings down on hinges between the gun barrels for servicing or for replacement.

Aviation RADIO

Dialing the Air Waves with Don Fink

Transmitter-Receiver

The latest trick in making battery-operated transmitter-receivers easy to use is that announced by Taylor Airphone Products of the Long Beach, Calif., Airport. The standard Model BR-4 receiver and BT-4 transmitter have been mounted in a luggage-type carrying case resembling that of the usual portable radio receiver. The control panel at the top of the case permits tuning over the weather beacon band, (195 to 410 kc.) adjusting the antenna load, volume and on-off switch. Radiation is indicated by a flashlight lamp. The power output

Taylor's pick-up transmitter-receiver.

with standard batteries is ½ watt, but 1-watt operation may be obtained with two sets of batteries. The press-to-talk button on the microphone performs all switching operations. The range is 35 miles when used with an adequate trailing antenna. The weight is 13 lb. for single battery operation, 17 lb. for the double battery type. Normal battery life exceeds 100 hours. Two phone jacks are available, with sufficient sidetone between them to make the outfit useful in student instruction or for conversation. The crystal usually furnished is 3,105 kc., but other frequencies are available on order. The cost is $150.

This equipment, with its unique carrying case, should be of special interest to the private plane operator not wishing to go into heavier sets.

U-h-f Equipment

Two companion pieces of equipment for u-h-f communication have recently been announced by Radio Receptor Co. The Model 421 transmitter is a u-h-f unit for airport traffic control. The frequency range, 128 to 132 Mc, has been combined with a power output in excess of 100 watts, capable of 100 per cent amplitude modulation. The audio frequency characteristic is flat within 3 db from 100 to 4,000 cycles, and the distortion at 400 cps is less than 5 percent up to 95 percent modulation. A "tune-operate" switch is provided to lower the plate voltage during preliminary tuning adjustments, to protect tubes and components for excessive currents. The transmitter operates directly from a 110-volt 60-cycle line, and is housed in a single steel cabinet 76 in. high, 24 in. wide and 30 in. deep.

The series 424 u-h-f receivers are intended for airport traffic control and for general communications purposes. Three bands are available in different models: 60 to 66 Mc, 123 to 128.5 Mc and 140 to 144 Mc (the recent action of the Federal Communications Commission in assigning the band from 60 to 66 Mc to television has removed the usefulness of the first named band). Model 424 can be supplied with the first two bands, Model 424A with the second, and Model 424B with the last named. The sensitivity is such that 500 milliwatts output is produced with 5 microvolts input, 30 percent modulated, with 10 db signal-to-noise ratio. The selectivity is 5 db down at 60 kc. band width and 60 db down at 280 kc. Image and spurious responses are down 60 db. The audio output, 3 watts maximum, covers the range from 100 to 3,000 cps within 3 db, and the a-v-c holds the output constant within 3 db from 50 microvolts to 100 millivolts. Three Type 955 acorn tubes are used in the u-h-f circuits, and a total of fourteen tubes is used in all, including a voltage regulator tube. The net weight is 77 lb. The receiver is intended for rack and panel mounting.

UAL 5-kw Transmitter

The most powerful airline ground station transmitters yet used in this country, having a power output of 5 kw., are being installed for United Airlines by the Federal Telegraph Co. Eleven units are to be installed at LaGuardia Field, New York, Chicago, Cleveland, Denver, Los Angeles, Oakland, Portland, and Salt Lake City. Each transmitter is built in five to six sections, including power supply, modulator, air-filter, and two or three r-f units. The frequency range covered is from 2,000 to 15,000 kc. Air-cooling is employed in all the transmitting tubes, and the equipment is arranged for full accessibility from the front panels so that no waste space is needed at the rear.

UAL 5-kw. ground station installed by Federal Telegraph.

Already Enlisted for Hemisphere Defense

★ ★ ★

Back when "Hemisphere Defense" was a mere implication of the Monroe Doctrine, Ryan STM primary military trainers were doing yeoman's service in the air forces of Mexico, Guatemala and Honduras. As soon as "Hemisphere Defense" became a ringing challenge to the U.S.A. these modern metal low wing trainers were enlisted in the U. S. Army Air Corps. Constantly being supplied in increasing numbers Ryans play an ever more important role in the Army Cadet Training Program. Ryan Aeronautical Company, Lindbergh Field, San Diego, California.

CONTRACTORS TO THE U. S. ARMY AIR CORPS

As the favored primary military trainers, Ryan STMs fly the warplane markings of many progressive nations.

BUYER'S LOG BOOK

What's New in Accessories, Materials, Supplies, and Equipment

Decreased weight with increased efficiency are the chief features of the new Model 437 hand pump announced by the Pump Engineering Service Corp., Cleveland, Ohio. A saving in weight of 38.5 percent has been made over previous equipment through the use of aluminum alloys and by simplification of design. This model is supplied for emergency service only and not for continuous operation. It weighs only 2¾ lb. and is designed to supply fluids at pressures up to 1,500 lb. per sq.in. Displacement is .8 cu.in. per stroke, or 1.6 cu.in. per cycle.—AVIATION, *September, 1940.*

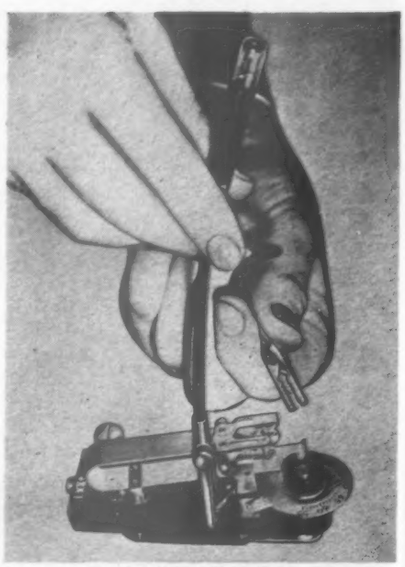
Pesco hand-operated hydraulic pump

Capable of measuring gasoline or fuel oil consumption down to the 1/1000th part of a gallon within an accuracy of 1/10th of 1 percent, a portable gallonmeter has been perfected by the Precision Meter Co., Portland, Ore. It can be used during actual plane operation, or during block testing, to determine fuel consumption. A control switch permits instant starting or stopping of measurement without interfering with continuous supply of fuel to the engine. Each 1/100th part of a gallon is electrically recorded on a dial, while fractional parts are readable by 1/1000ths on a translucent measuring cylinder.—AVIATION, *September, 1940.*

Precision gallon-meter

Known as the low-voltage Tattelite (It-Tells-The-Tale) pocket tester, a new product of Littelfuse, Inc., Chicago, Ill., is finding wide application for checking aircraft and aircraft radio circuits. Designed to cover a range of 3 to 25 volts a.c. or d.c., or momentary to 50 volts, the device has alligator type clips and a high temperature coefficient lamp housed in a transparent tenite case.—AVIATION, *September, 1940.*

Developed to provide a compact, easily-installed airplane fueling system for maximum utility, the "Serv-a-plane" airport service station offered by S. F. Bowser & Co., Inc., Ft. Wayne, Ind., should find wide application on existing fields, and new airports to be built under our expanding air program. The standard Type 276 Serv-a-plane unit is a beautifully finished cabinet, with chromium trim, ready to set on a concrete base, and incorporating all the usual service requirements for fuel, lubricating oil, windshield cleaning, fire protection, etc. Pump capacity is 15 to 20 gal. per minute and the hose is wound by power. Complete equipment of the standard Serv-a-plane unit includes: Cabinet, pumping unit, strainer and air release, water separator, Xacto Meter, sight glass, power-driven hose reel, 100 ft. of 1 in. aviation hose, nozzle, two shelves for lubricating oil, windshield cleaning equipment, sales slips, etc., electric switch and light for night illumination, mounting for 2-qt. fire extinquisher.—AVIATION, *September, 1940.*

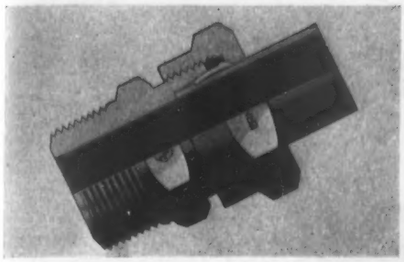


Littelfuse Tattelite

Making satisfactory plain tube joints, especially under conditions of high pressure or extreme vibration, is simplified through use of the Ermeto safety tube and pipe coupling announced by The Weatherhead Co., Cleveland, Ohio, who are sole American distributors for this French development. The Ermeto safety fitting is quite simple. A plain tube is inserted in the coupling and the nut is tightened with an ordinary wrench. This action forces a hardened ring, or sleeve, to shear itself into the outside surface of the tube. The resulting joint has a strength heretofore considered impossible for tube connections and is especially satisfactory for high-pressure hydraulic systems, although equally applicable to low-pressure lines. Joints of any type of tubing material can be made, will not loosen under use, may be uncoupled quickly, and may be assembled and dis-assembled an unlimited number of times without replacement of any parts.—AVIATION, *September, 1940.*

An indication of the rapidity with which scheduled air transportation is developing is found in the production of a tractor designed specifically for airport work. Such a tractor is the Oliver "25" airport tractor, built by the Oliver Farm Equipment Sales Co., Chicago, Ill., and which is now in use by TWA, Mid-Continent, Delta, American, Pennsylvania Central Airlines, and numerous airports. These streamlined but powerful little machines are usually the busiest

Serv-a-plane fueling system



Weatherhead Ermeto coupling

Oliver "25" airport tractor

Explosion-proof micro switch

Grob metal band saw

equipment on the field. They are the "tug boats" of aviation and, in addition, perform dozens of odd jobs, such as mowing the grass and weeds, pushing snowplows to clear runways, pulling grading equipment, etc. The Oliver "25" has electric lights, self starter, six-cylinder engine, short turning radius, differential steering brakes, and numerous fittings and accessories to adapt the machine to all airport work.—AVIATION, *September, 1940.*

An explosion-proof micro switch of unusually compact dimensions is now offered by the Micro Switch Corp., of Freeport, Ill. Measuring $3\frac{1}{8} \times 2\frac{1}{2} \times 2$ in., the switch is listed by the Underwriters' as suitable for use in atmospheres containing vapors of ethyl ether, gasoline, alcohol, acetone, lacquer solvents, grain dusts, etc. A removable cover plate provides easy access to the rugged terminals. The switching unit is a standard precision micro switch with a listing of 1,200 watts up to 600 volts a.c.—AVIATION, *September, 1940.*

An improved model 18-in. throat metal band sawing machine has been announced by Grob Brothers, Grafton, Wis. Such machines have now become standard in practically all aircraft factory tool rooms and are playing a big part in speeding production. The new Grob, Model NS-18, has a one-piece welded steel frame, a heavily ribbed cast iron table, tiltable four ways, a built-in cabinet for tool storage and other improvements. Optional features include automatic hydraulic checked table feed, light attachment, air blower, circular cutting attachment, magnifying glass, and tachometer.—AVIATION, *September, 1940.*

Boon to aircraft maintenance shop is the new ferrule attaching machine for swaging fitting to flexible radio shielding conduit, that is now offered by the American Metal Hose Branch of the American Brass Company, Waterbury, Conn. Employing the principle of double beading, the machine is small and compact, is designed to attach to the work bench, and is manually operated. The whole operation of attaching ferrule to conduit requires less than a minute.—AVIATION, *September, 1940.*

Featuring an eight-sides scale selector, the Model A-338 instrument testing manometer developed by The Meriam Co., Cleveland, Ohio, checks calibration of altimeters, air speed indicators, rate-of-climb indicators, fuel pressure gauges, manifold pressure gauges, actuating diaphragms, etc.—AVIATION, *September, 1940.*

A new auxiliary power plant unit for airplanes has been announced by Lawrence Engineering & Research, Linden, New Jersey. The power supplied by this unit at sea level is a continuous output of 5 kw. or an output of 7.5 kw. for a period of five minutes. Built for high altitude operation also the unit is capable of producing 3.25 kw. continuous output at 20,000 ft., all current being 24 volts. The model number of the new unit is AO-28 and its dry weight is 120 lb. The generator is driven by a two cylinder opposed air cooled motor which runs at a constant speed of 4,000 rpm. The unit is already in use on many military airplanes.—AVIATION, *September, 1940.*

A unique method of airplane hangar construction has been developed by R. G. LeTourneau, Inc., at Toccoa, Ga. A test hangar, 92 ft. square, contains no separate frame work. The side walls are self-supporting and they, in turn, support the roof. The structure consists of arc welded steel panels stamped in a press to a sunken panel design, and then welded together in pairs. These panels are, in turn, welded to adjoining panels to form a wall, floor, or ceiling. For insulation purposes rock wool is forced into each panel to a density of 10 lb. per cu.ft.—AVIATION, *September, 1940.*

R. G. LeTourneau, Inc., airplane hangar

¾ Actual Size

Improved GAP SETTING TOOL

Light Weight . . . . Compact . . . . Complete

•

Especially designed for Field Service Tool Kit

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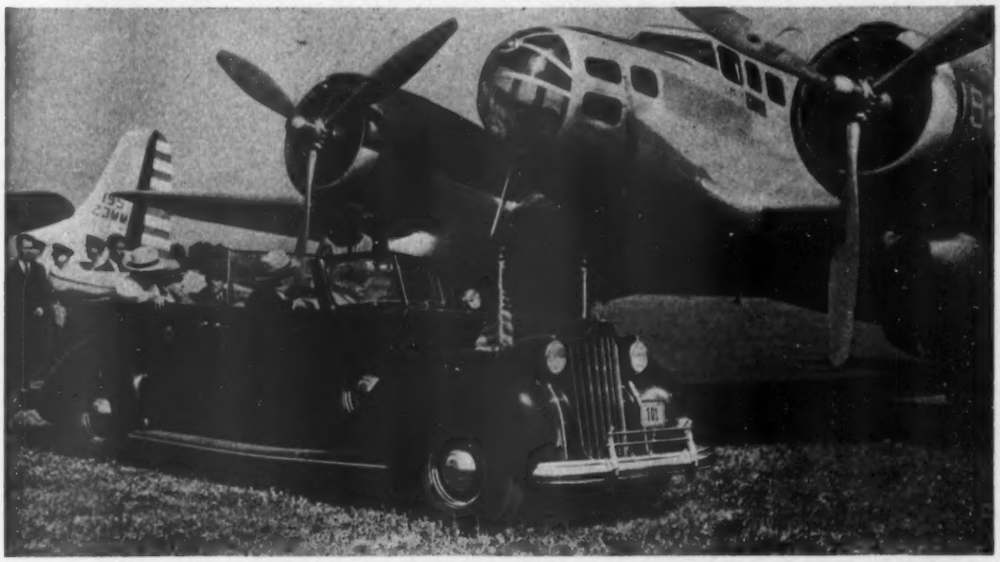
THE Aviation NEWS

BLAINE STUBBLEFIELD, Washington | C. F. McReynolds, Pacific Coast | Jay P. AuWerter, New York | E. R. Lockin New York | SEPTEMBER 1940

Wide World



Right: History in the making. In the rear of the car, left to right, are President Roosevelt, Prime Minister Mackenzie King of Canada, Sec'y. of War Stimson. They are reviewing 127 U. S. battle planes at Ogdensburg, N. Y. during the war games, and discussing a North American defense plan, whereby U. S. and Canada act together to establish air bases.

Lower right: Practising parachute jumping at Heightstown, N. J., where men from the U. S. Infantry School at Fort Benning, Ga., are going through a course of jumps. Unlike the 'chute jump at the World's Fair, these fall freely from the 125 ft. tower. Top arm of the tower can be rotated, permitting 'chute to drift away from the base.

Acme

The Industry and Administration Reach Agreement Start Huge Airplane Building Program

Washington (AVIATION BUREAU)—After weeks of nervous delay and uncertainty, aircraft manufacturers finally decided to sign contracts for production of most of the 4,200 plane program for which money was provided in the first defense appropriations. Since this group of orders can be handled without substantial plant expansions, the industry agreed to go ahead without waiting for enactment of the excess-profits and amortization legislation.

North American Aviation, Inc., was the first to sign, under an award of $11,335,631 for 700 trainers. Within a few days Fairchild Engine & Airplane Corp, received a contract for 100 trainers costing $1,038,300, with Consolidated simultaneously awarded $14,861,342 for production of 56 four-engine bombers. The following day, Beech Aircraft Corp. signed up for 67 training planes at $3,410,746, and Boeing's Stearman Aircraft Division for 337 trainers, totaling $2,041,947. Some half-dozen additional contracts pending at Wright Field were expected to be consummated before the end of the month.

So complete had the hold-up in production been that for seven weeks after money was available, contracts were let for only 33 planes. Early in July the decision had been reached as to what planes would be built by each manufacturer, and the manufacturers had been notified of their allocation. Moreover, the administration and Congressional leaders had announced that Vinson-Trammell profit restrictions would be lifted and amortization of new facilities permitted over a five-year period. The administration, however, insisted that these changes be incorporated in one general excess-profit tax measure which everyone knew would take months.

Early in August, at a hot meeting of manufacturers with Defense Commission and military officials, agreement was reached in principle on going

(*Turn to page 81*)

NATIONAL Aviation

Gravelly Point Progress

Down the Potomac a quick mile they are laying asphaltic concrete runways and raising buildings on the new Gravelly Point national airport. Runways, about 21,000 ft., will be ready for use in late October, but the taxiways and buildings will take till November some time. The date of beginning operation is not yet certain. There will be one hangar, but a bill is before Congress for money to build five more. Each of the three lines serving Washington (*PCA, AA,* and *EAL*) say they want two hangars, and other lines, including United, want to come in here. There is talk that maintenance will be expanded at this point, which is convenient on the north-south routes. Some of the most practical and also nifty features of any airport in the world will be seen at Gravelly Point. AVIATION will tell all about it pretty soon. The finishing touches will not be on till some time next summer. After all the talk about swell buildings at the field for CAA it looks now as if the swivel chair flyers may stay in town; they have no appropriation to erect a building.

Major concessions at the field have been awarded to Jacobs Brothers, of Buffalo, chain restaurateurs, and the Gulf Oil Co.; these concerns offered most favorable propositions on bid basis.

Amortization Speeded But Profits Taxed

Washington (AVIATION BUREAU): The tax-amortization legislation has a long way to go before it reaches the President's desk, and some changes in the original draft are already being discussed, but chances are the broad outlines will be retained. Briefly the bill would permit amortization of plant, for tax purposes, over a five-year period, and would tax "excess profits" at a rate ranging from 25 to 40 percent.

The rapid amortization would apply both in computing the excess profits tax and ordinary income tax. The period of amortization may be shorter. If the emergency is terminated by the President in less than five years the amortization may be re-figured retroactively over the shorter term. Similarly, if the Secretary of War or Navy certifies that a particular facility is no longer useful for munitions production, it may be amortized over a period during which it was useful. These procedures now apply to "lands, buildings and machinery or equipment" installed after July 10 of this year. The administration is supporting a change which would make the date Jan. 1, 1940.

To be eligible for rapid amortization, facilities must be certified by the Defense Commission and the Army or Navy.

There is a possibility that some strings may be put on rapidly-amortized facilities. Army and Navy are believed to favor a plan by which facilities would have to be maintained in shape to produce munitions, on a standby basis, after being written off. This is opposed by the Defense Commission.

The subcommittee preparing the bill recommended that if defense orders cease before the manufacturing facilities are paid for, the government reimburse the manufacturer for the difference and that such payments be exempt from taxation.

The bill repeals Vinson-Trammel limit on profits of ship and plane manufacturers and substitutes an excess-profits tax applying to all corporations (except personal service corporations), defense or otherwise. The first $5,000 of excess profit is tax-free. Thereafter a tax must be paid varying from 25 to 40 percent depending on the ratio which excess profits bear to normal profits.

The excess profit to be taxed is the difference between actual earnings and a theoretical normal profit based on experience during a base period 1936-39. Leaving out some technicalities it works about like this:

A corporation which during the base period earned less than 6 percent on its first $500,000 of invested capital and 4 percent on the rest would be considered normally entitled to these earnings on the capital with which it entered 1940 plus 8 percent on newly invested capital.

A corporation earning a greater return than this during the base period but less than 10 percent would be allowed the same return during the tax year as during the base period.

Normal earnings of a corporation which earned more than 10 percent in the base period would be taken as being equal to the average dollar earnings in the base period plus 8 percent on new investment.

New corporations would be allowed 8 percent on capital.

Invested capital is considered as all the equity capital plus a percentage of borrowed capital ranging from all to a third depending on amount.

Wide World

Pilot's license No. 1 was awarded to Orville Wright, center, by Edward P. Warner, right, at the dedication of the new Wright Memorial at Dayton on Aug. 19.

Women's Clubs Growing

The "Ninety Nines," an international organization of women pilots, decided at Denver to affiliate with NAA, and now they have established headquarters with NAA at the Willard Hotel in Washington. Miss Cecile Hamilton is in charge of the D.C. office and she also does work for NAA. Betty Gillies, president, is not moving to Washington. The Ninety Nines now have 400 members, hope to have 1,000 by the year-end. Headquarters keeps employment files on members, recording their abilities in flying, in secretarial and public relations work, in modeling clothes, etc. Good place to look for employees with aviation experience.

A new women's air organization, Women Flyers of America, is growing rapidly in the East. It is a training group, not competing against the Ninety Nines, which is an association of trained pilots. Miss Chelle Janis is president. The membership is reported as 1,000, all taking flight training. By September the group hopes to number 5,000. All are paying for their own time at special rates of $275 each, in regular approved CAB schools.

Leaders of women's flying groups say they do not expect to fly combat, which probably would not be permitted anyway, but they believe they can instruct and ferry planes, relieving many men for combat service.

Now It's 50,000 Pilots

Washington (AVIATION BUREAU)—The pilot training program of CAA is judged by nearly everybody to be a big success; almost no criticism has been or is directed at it; Assistant Secretary of Commerce Robert Hinckley, its chief sponsor, is given unreserved credit for the job. The work is now under supervision of new Administrator Col. Donald Conolly.

The aim is to train 50,000 pilots by next June 30. No one pretends any longer that this is without a military flavor. The training program is five times as large as that of last year. More than 32,000 ground school students have "matriculated" and 17,494 are in flight courses. Nearly 1,000 instructors are in "refresher" courses. Nearly 16,000 students will complete both ground and flight training, up to private pilot grade, by September. Then two more similar batches will be trained this fall and next spring. Activity will be somewhat limited in winter, but will go right on.

Ground school training started in 499 colleges, and these same students, at the same time, started flight training in 528 commercial air schools near the campuses. Since June 15 the students have flown over 100,000 hours without a fatality. On July 1, 15,000 non-college students began ground school training. The top ranking 2,000 of these will get flight courses this year. Another group of 375 non-college students who could not get training last year were started on July 1.

This year about 9,000 primary course graduates will get secondary training, after having passed the Army or Navy standard physical test, and will be a source of recruits for the services. A similar group will get started this fall. Refresher courses will be offered to about 5,000 former pilots this year. About 15,000 applications for refresher courses have been received, many from pilots who have let their certificates lapse.

Research laboratories at 25 universities are studying methods of selecting and training flyers, hoping for improvements of technique.

United Aircraft Plans Large Expansion Program

News from the direction of Hartford, Conn., reports that Pratt & Whitney and Hamilton Standard Propellers and Vought-Sikorsky Divisions of United Aircraft are in line for still further expansion. $12,000,000 will be spent at Pratt & Whitney and Hamilton Standard which will bring up their engine production to about 1,500 engines a month. Vought-Sikorsky will spend $3,000;000 to double its productive capacity. Interesting to note is that the financing will probably be carried on with private capital.

CIO-UAW Organizes Plane Division

An intensified drive to bring aircraft workers into CIO's United Auto Workers Union is to begin in January. An airplane division has been formed in UAW headed by Walter Smethurst, a CIO organizational director who came up through the miners.

New Airport Program

C.A.A., War and Naval officials struggled through endless meetings to devise a new airport construction program which, this time, has the administration's blessing.

A sizeable new appropriation is expected to receive Congressional approval for expansion of the country's airport network. Present plans call for establishment of new fields which will assist in pilot training programs, convenience of commercial air lines, and anticipated military defense needs.

Not yet completed at press time, the proposed bill would total between $200 million and $500 million. Planned originally as a C.A.A. project, rumors have currently circulated that the War Department may prefer a military airport program of its own.

The three outstanding pilots in the CAA training program, winners in the contest sponsored by the Institute of the Aeronautical Sciences for the Shell Intercollegiate Aviation Scholarships, are shown receiving their checks from Robert H. Hinckley, assistant Secretary of Commerce. Left to right: Waldo E. Schroeter, senior in agriculture at University of California, who won third scholarship of $500; Jefferson Davis Lewis, graduate of University of Florida, who got second award of $750; Secretary Hinckley and Edward F. Scanlon, graduate of Kenyon College, who won first scholarship of $1,000.

THE WASHINGTON WINDSOCK

by BLAINE STUBBLEFIELD

A 45-ft. propeller, we hear tell, is in the works for the air services; equipment for building it is being designed. The prop will absorb about 8,000 hp. turning at 800 r.p.m. Some of the dope has this big wheel hooked up with steam turbines that keep slipping into rumors. Also a 450 m.p.h. wind tunnel is in the back-stage news, with a 32,000 hp. blower.

You may be surpised to hear a report that the Army is just now getting around to a survey of the air fields and other facilities which would be available in South America if the U. S. were called to help defend one or more of those countries. It has been only three or four years, we are told, since the Air Corps inquired about fields on the way to Mexico City. The Army is not delinquent; it has had no personnel to make these studies.

Air Corps was concerned about the hop between Seattle and Alaska which was too long for pursuit planes. But the new field at Metlakatla, an Indian village in extreme southeast, cuts the jump to less than 600 miles, which is not bad. Canadian intermediate ports are available, but Army doesn't like to depend on the good graces of a neighbor.

Only one thing could stop the present rush of airplane and armament production in the United States; the defeat of Britain and a peace lullaby by Hitler. But if Britain wins there will remain the threats of Japan and Russia, against whom we will go on preparing.

If England beats Germany with airplanes alone, the old theory that planes cannot take and hold land will be exploded, and the prestige of aircraft as weapons will go still higher; so will the production of same.

There is no agreement among CAA, War and Navy officials whether in emergency the air system should be trimmed to give to the services planes and pilots. But so far War and Navy are not objecting to expansion of air transport.

Instrument landing experimentation on the ten stations is going ahead satisfactorily. Although one kind of equipment is being used, the Administrator's mind is open on the future. It will be at least a year before any scheduled line landings will be made; maybe more.

The Stubblefield Award this month goes to Gen. Sir Alexander Godley, former commander in chief of Gibralter, who says it would be very difficult to attack the Rock with airplanes because of "the tricky winds and innumerable air pockets which surround it."

Assistant Secretary of Commerce for Air, a title once worn by Bill McCracken and Clarence Young, was said to be still extant and might settle on the brow of Mr. Hinckley. But it won't. The title was abolished in a Reorganization Act years ago. Mr. Hinckley's reponsibilities include the Weather Bureau, in addition to aviation.

July passenger traffic on domestic air lines established a new peak for the fifth consecutive month, while the gain over July, 1939, amounted to more than 50 percent. Further gains are anticipated up through October and the year's total may exceed one million revenue-passenger-miles, as compared with 677 million in 1939, the best previous year.

Congress threatens to investigate the airlines for failure to make inter-connecting schedules and not warning passengers in advance.

Calling Names

Joseph M. Shanaphy—to the post of new air traffic executive of Railway Express Agency's Express Division.

Airlines News Theater in the Airlines Terminal, N.Y.C., designed to cater to the air travel public, to open soon.

Carl Swanson, research engineer of Northwest Airlines, honored by a group of research engineers for his invention of a new ignition system.

Heracles, most famous air liner of the Imperial Airways, has been scrapped, but her aluminum will fly again in Spitfires and Hurricanes.

Leonard A. Schuttig, named government Division Manager of Lear Avia, Inc., in Washington.

Kendall K. Hoyt, appointed publicity director of the NAA, Washington.

Winged America, a new pageant in the Aviation Bldg. at the World's Fair is open, and will show the development of aviation.

Gordon Israel, appointed chief engineer of the Howard Aircraft Co.

Igor Sikorsky, spoke on a radio program called, "I am an American" which aims to show the opportunities open in the American aviation industry.

Private Flyers Association, Inc., estimates an increase of 500 per cent over 1939 for private flying in 1940.

Harold Caminez, appointed executive engineer of Air Associates, Inc.

CAB announces pilots with temporary disabilities to retain their certificates by co-piloting.

C. V. Whitney, Chairman of the Board of PAA, presents to Relief Wings, Inc., a plane to use on errands of mercy.

Lieut. O. E. Tibbs, Air Corps Reserve, flies Southern Aircraft Corporation's Model BM-10 military primary trainer, just completed, as test pilot.

Prof. John D. Akerman, head of the Department of Aeronautical Engineering of University of Minnesota, spends the three-month summer period with Boeing as consultant on company's research program.

Air Vice-Marshal S. J. Goble of Royal Australian Air Force takes over duties as Australian Air Liaison Officer. Berthed at Ottawa he has charge of technical administration of the British Commonwealth Air Training Plan.

T. T. Hildebrandt, 1128 Woodward Building, Washington, is Washington representative of Aero Equipment Corporation's Aircraft Division.

Harry F. Guggenheim, for ten years a member of the N.A.C.A., is named chairman of a new Aviation Division of the Republican National Committee for the election of Wendell Willkie. The Division, "Wings for Willkie," will organize on a nationwide basis.

Max J. Pollett, district sales manager for American Airlines at Buffalo, is now assistant to Vice President O. M. Mosier, with headquarters in New York. A. B. Newcombe, assistant district sales manager in New York City, takes over for Pollett.

William P. Lasster becomes export manager of John A. Roebling's Sons new export division, located at 19 Rector St., New York City.

Frank E. Tobin, former Senior Air Carrier Inspector for CAA at Atlanta, Joins Texas Company as aviation lubrication engineer, with headquarters in Kansas City, Mo. Formerly connected with Lockheed and National Parks Airways.

S. A. (Art) Newman proudly displays Lear Trophy for second place in Pittsburgh Aero Club's efficiency race to White Sulphur Springs,—credits Lear's 5 watt transmitter.

W. Leslie Lawrence elected secretary of Alexander Milburn Co., succeeding the late Harvey H. Johnson.

James Deresa joins American Airlines' agency department in Chicago. Speaks five languages.

W. L. Smith resigns his post as director of air purchases for the British Purchasing Mission.

H. H. Krause, with National Screw & Manufactury Co. for 20 years, appointed purchasing agent of Pump Engineering Service Corp.

Ed Clarke, responsible since its inception for the development of the Junior Aviator movement throughout the country, becomes aviation editor of The Cleveland Press. Will continue as National Junior Aviator Editor for Scripps-Howard newspapers.

Howard E. Salisbury appointed manager of Air Reduction Co. at Philadelphia. H. B. Seydel appointed assistant manager.

Wiliam T. Barton made purchasing agent of American Bosch Corp., succeeding Joseph F. Drennan, newly appointed purchasing agent for Springfield, Mass.

Justin D. Bowersock, aviation editor of The Kansas City Star, wins TWA's trophy for best aviation writing in 1939.

Edward A. Tappe, manager of TWA's passenger relations department at Kansas City, named chairman of the National Aviation Committee of the United States Junior Chamber of Commerce. Mark Matthews of New York is president.

John D. Baldwin, Jr. is established in Los Angeles as resident engineer of the airplane division of The Weatherhead Co.

William Sample, Jr. is supervisor of reservations and ticket offices in Los Angeles for American Airlines. Ralph Radcliffe, Jr. replaces him as sales correspondent, and is in turn replaced by Earl Bouilly as sales manager in Oklahoma City.

Russell DeYoung appointed assistant to the president of Goodyear Aircraft Corp. and of Goodyear Foreign Operations Inc.

L. Lockwood York joins Aircraft Engine Division of Continental Motors Corp. as sales and service engineer.

Don Frye, former personnel director for Consolidated Aircraft Corp. has resigned to develop a new type light airplane. Preliminary work on the plane is underway in Kansas City, Mo. Frye is a brother of Jack Frye, president of TWA. J. H. Waterbury, assistant personnel director, has been promoted to the post of personnel director.

Pratt & Whitney division of the United Aircraft Corp. celebrates its fifteenth birthday.

Federal Reformatories are now setting up aviation mechanics training courses for inmates, in line with their industrial training program. Other schools warn of sabotage risk.

Engineering Index, Inc., announces its 55th annual edition.

Mason Britton, vice president of McGraw-Hill Publishing Co., is supervisor of machine tools in the production section of the National Defense Commission.

Col. Henry Breckinridge was elected chairman of the board of directors of Aviation Equipment & Export.

Lieut. T. T. Ludlam is elected executive vice president of Hahn Spark Plug Corp. John B. McPherson is vice president in charge of research and developments, and John R. Stewart is treasurer.

Harry Hopkins, Secretary of Commerce, which now envelops civil aviation, says airlines are carrying 9,000 passengers daily, looks ahead to 100,000 a day.

Women's flying clubs won their demand on CAA that expectant mothers be allowed to fly to hold certificates; Washington grants them permission to co-pilot.

Capt. H. B. Rueschenberg, Northwest Airlines pilot, is developing plans for a steam airplane power plant. He also is working out a supercharged accordian with a pump for playing at high altitude.

NAA Aims

The National Aeronautic Association is putting its energies behind three objectives: to expedite national defense; at the same time to prevent the civil aviation program from being forgotten; and to promote a federal appropriation by this session of Congress for construction and maintenance of airports.

NAA's National Defense Committee, with Wm. P. McCracken, Washington attorney, as chairman, held its first meeting and scheduled more meetings to formulate specific policy and to take action on cooperation with all federal aviation services, to expedite the defense program. At the same time, Gill Robb Wilson, president of NAA, was using all his influence and that of his organization toward an appropriation by Congress for a vast airport program which would implement national defense, and at the same time stimulate private aviation.

Wide World

A brand new step in training Air Corps navigators was taken when the War Department sent the first class of 50 students to the University of Miami, Fla. Instruction is given by experts of Pan American Airways, veterans of flight navigation.

Harris & Ewing

The CAB sits for its picture. Seated, left to right: Grant Mason, chairman Harllee Branch; vice chairman Edward P. Warner. Second row, left: new member George B. Baker, formerly associate professor of transportation, Harvard University. Right: Oswald Ryan.

New Howard Distributor

Wings Field Aviation Country Club has established a new division of its organization, to be known as "Seaboard Aircraft Sales." Warren Holliday has been appointed manager and is now distributor for Howard Aircraft with headquarters at Hangar E, Roosevelt Field, N. Y. His territory covers New England, New York, and all seaboard Atlantic states including Florida. He has a new Wasp powered Howard demonstrator, and promises 30 day delivery on new ships. Wings Field is co-distributor, under direction of Guy and Buck Miller, president and vice-president of Wings Field.

Aviation DEFENSE

New Wright Engine Plant

Lockland, Ohio, is the site for the new plant of the Wright Aeronautical Corp. The company has purchased 200 acres of land just north of Cincinnati. Of single-story construction, the factory will comprise more than 1,000,000 sq.ft., or over 25 acres of floor space.

It is expected that 1,000 Cyclones per month will be made, and between 12,000 and 15,000 persons will be employed, about 60 percent of whom will have come from local vocational schools. Contracts are now being placed for some $8,000,000 worth of machine tool equipment. Actual construction work will begin at once.

Air Base Program

U. S. air bases on British islands from Newfoundland to the Caribbean advanced to the point of actual negotiation over the past two weeks, Winston Churchill announcing from London approval of a 99-year lease arrangement. The "agreement in principle" is expected to be converted into formal proceedings allowing establishment by this country of both air and naval defense outposts on British possessions near the eastern coast of the Western Hemisphere. Conversations on the program with Canada were simultaneously announced.

Long discussed in political and military circles, the news aroused excited reactions, varying from enthusiastic endorsement of the move as a defense measure to charges that it would tie us too firmly to the British and bring us closer to the war.

On our own territory the expanded air base construction program moved forward: work began on three new Naval Reserve Bases at New Orleans, Dallas and Atlanta; plans were announced to enlarge thirteen others to train 1,600 reserve pilots monthly; construction of Army air bases in Alaska were reported well ahead of schedule. In addition, WPA approved almost $7,000,000 for Army and Navy air base expansion.

Substantial additional funds for this phase of the defense program are provided in the new Second Supplemental Defense Appropriation.

Reports grew meanwhile that the Navy might take over entirely Floyd Bennett Field where the $700,000 seaplane base is nearing completion. Such a move, however, offers many complications despite its suitability for Naval operations, because of the increasing importance of the airport as an auxiliary commercial field as air traffic in the area increases, location there of civilian flying schools, and similar considerations.

Packard's Plans

Packard is going ahead with the manufacture of Rolls-Royce Merlin engines. It is reported now that the War Department's order for 9,000 engines may not be enough to fully occupy available Packard plant. The plan now, it is understood, is to build only parts in the body plant, and to assemble and test in a new plant, near by, to be built with $8,000,000 RFC—money.

Packard is spending about $100,000 on changes in design for facility in manufacturing. Packard is said to have taken over from Ford the blueprints which were in possession of that company during negotiations with the government. Those negotiations failed because Mr. Ford refused to build engines for the British. Whether Packard received Ford's changes in the design, or whether Packard got only the original Rolls designs, is a question.

Ford is reported on good authority to be going ahead with plans to manufacture Rolls engines, making his own design changes following his original study of the engine. Some observers believe that he may be able to get into production before Packard does, since he has a head start. Washington naturally would be pleased to have two manufacturers building Rolls engines. It could not be learned at this writing whether or not Ford had agreed to build Pratt & Whitney engines, but the contract had not been signed.

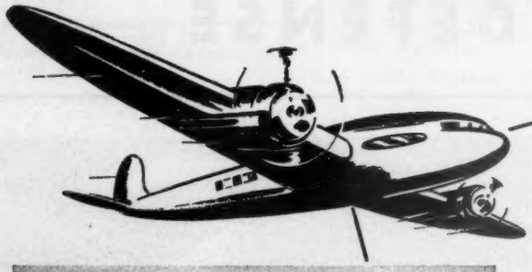
Republic Guardsman carries a 750 lb. fuselage bomb under its belly, and six 100 lb. wing bombs. The heavy bomb is lowered by a displacing gear before it is dropped, to clear the propeller. This dive bomber has forward-firing fuselage machine guns, and a revolving gun turret. Ship is a two-seater.

International

Largest mass enlistment in history took place in Philadelphia last month when 287 new high school graduates joined the Air Corps. All were sent to Bolling Field. Lieut. Col. Frederick Schoenfeld is shown administering the oath.

Army, Navy Store Gas

Storage of large quantities of 100 octane gasoline is being studied by a special committee of the National Defense Commission, headed by Dr. Robert E. Wilson, who is in charge of the Petroleum Section. Committee members are outstanding terminal designers, serving without pay. Underground, bomb-proof storage has been frequently mentioned, but the committee has not as yet made known its lines of thought.



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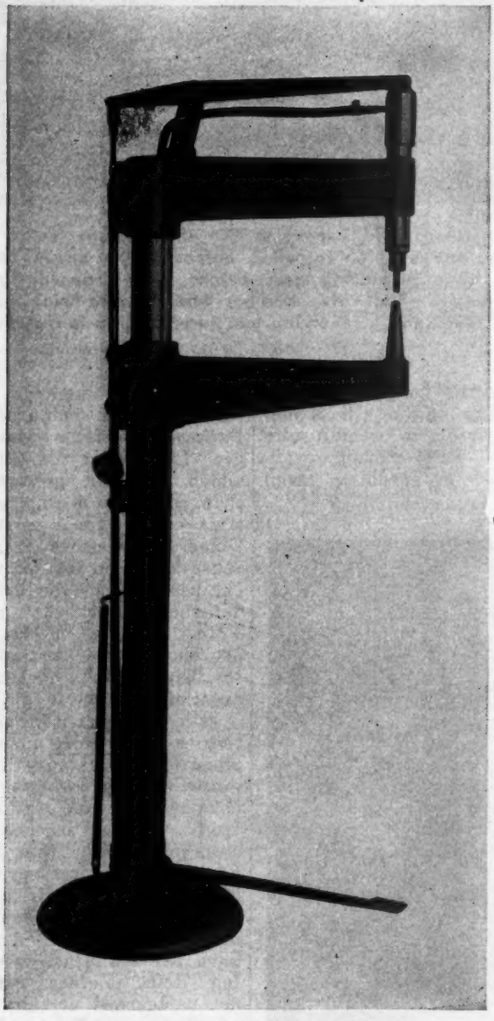

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For faster, lower-cost dimpling or riveting on production lines . . . two new CP Stationary One-Shot Riveting Hammers. » » » CP-211 Hammer uses the standard CP-209 One-Shot Hammer (capacity, 3/16" Dural Rivets). » » » CP-212 Hammer uses the standard CP-207 One-Shot Hammer (capacity, ¼" Dural Rivets). » » » Write for Supplement "A" to SP-1851, and SP-1851, covering complete line of CP Aviation Tools.

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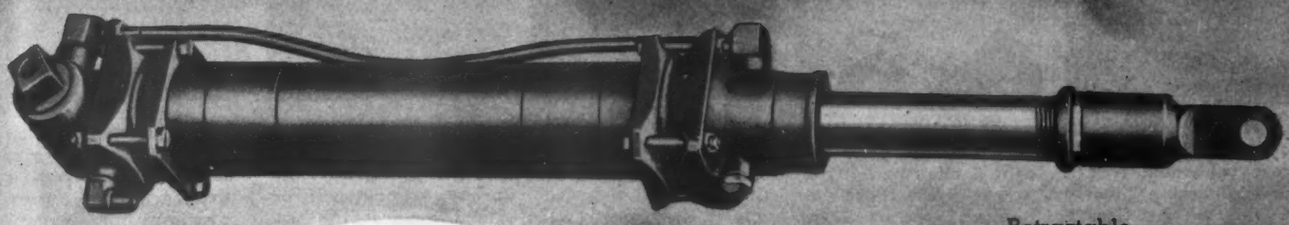
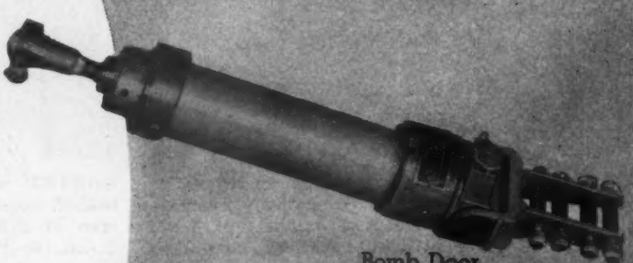
HYDRAULIC CYLINDERS



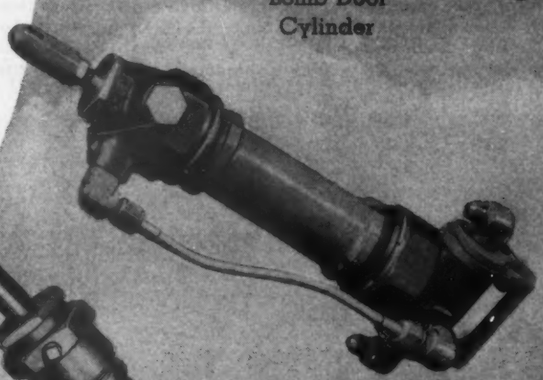
Retractable Landing Gear Cylinder

Wing Flap Cylinder

Here are a few of the Pesco Hydraulic Cylinders and Locks now in service on modern aircraft. These units combine meticulous design, carefully selected materials and precision workmanship to achieve the utmost in strength and dependability with minimum weight. Pesco engineers are prepared to design and build similar equipment for applying hydraulic power to a wide variety of mechanical functions.



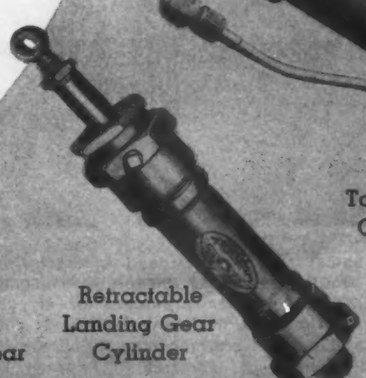
Bomb Door Cylinder



Tail Wheel Cylinder

Lock for Extended Landing Gear

Lock for Retracted Landing Gear



Retractable Landing Gear Cylinder

PUMP ENGINEERING SERVICE CORPORATION

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Aviation PEOPLE

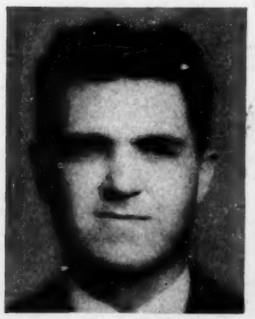
A. WARD KNISLEY, for the past 11 years connected with the Engineering Department of the Air Corps, joins Barnard Aviation Equipment Co. as vice president in charge of sales.

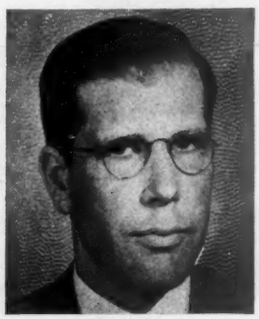
JAMES G. HALL has been elected vice-president & chairman of the executive committee of Bennett Aircraft Corp. He holds several flight records and has engaged in varied business activities.

EDWIN E. ALDRIN has been appointed special consultant to Col. D. H. Connolly, Administrator of Civil Aeronautics, to advise on airports, airways, pilot training, and technical development.

NEW POST of Air Traffic Executive created by Railway Express Agency will be filled by Joseph M. Shanaphy, who will direct, develop and coordinate air transport and rail express.

NEW MANAGER of Lockheed Aircraft's service department is Reagan Stunkel, veteran airline maintenance expert, and for the past year in charge of inspection & service for Vega Airplane Co.

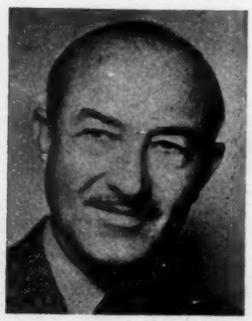


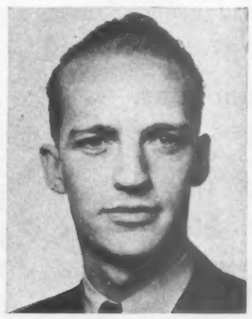


GEORGE W. LESCHER (l.) and DONALD W. WEED have been appointed respectively executive engineer and assistant executive engineer of Republic Aviation Corp. They will direct the administration of the engineering department in association with Alexander Kartveli. Lescher has been serving as acting executive engineer; Weed was project engineer on the Air Corps contracts.

ROBERT H. HINCKLEY (l.) former chairman of C.A.A., accepts from Harllee Branch, present chairman of C.A.B., resolution passed by members of C.A.B. in "acknowledgment of the valuable services rendered by him to the advancement of American civil aviation, and the personal pleasure which the members of the Board have derived from their association with him."

EDWARD J. NOBLE, first chairman of CAA, has resigned as Under Secretary of Commerce to work for election of Willkie. Noble states his interest is in national defense, not Senate.





CHANGES in the executive sales force of Lockheed Aircraft Corp. have been announced by V. P. Carl B. Squier. (l. to r.) Joseph R. Hargrove, in charge of service division since 1937 and former president of Hargrove Aircraft, becomes manager of the domestic sales division; Ferris M. Smith, formerly in charge of domestic sales and project engineer for the Army XC-35, is made manager of the export sales department; Charles F. Thomas, stress analyst, structures group engineer and project engineer, is appointed technical sales engineer.

C. M. WEAVER has joined the staff of Boeing Aircraft Co.'s Manufacturing Dept. For the past six years Weaver has been superintendent of maintenance for United Air Lines at Chicago.

LOUIS H. ENOS is new assistant chief engineer at the Curtiss Propeller Division of Clifton, N. J., and C. W. Chillson heads the research engineering section.

AGAIN... A BOEING FIRST! Continuing the ascendancy of BOEING 4-engine aircraft, which began with the development of the mighty Flying Fortresses for the U. S. Army Air Corps, BOEING now steps forth as the first airplane manufacturer to provide 4-engine commercial air transports for passenger lines encircling two-thirds of the globe. From Lisbon to Hong Kong, the new standards of luxury, speed and reliability for which BOEING 4-engine airplanes are famous are now available to air travelers. For more than a year, giant 41-ton BOEING-built Clippers have been flying the Atlantic and the Pacific on Pan American Airways' routes. Transcontinental & Western Air, Inc., recently completed the great 15,000-mile span by inaugurating 4-engine BOEING Stratoliners on their established coast-to-coast route. In addition Pan American Airways are now using BOEING 307 Strato-Clippers in intercontinental service to Rio de Janeiro.

Boeing has always built tomorrow's airplanes today!

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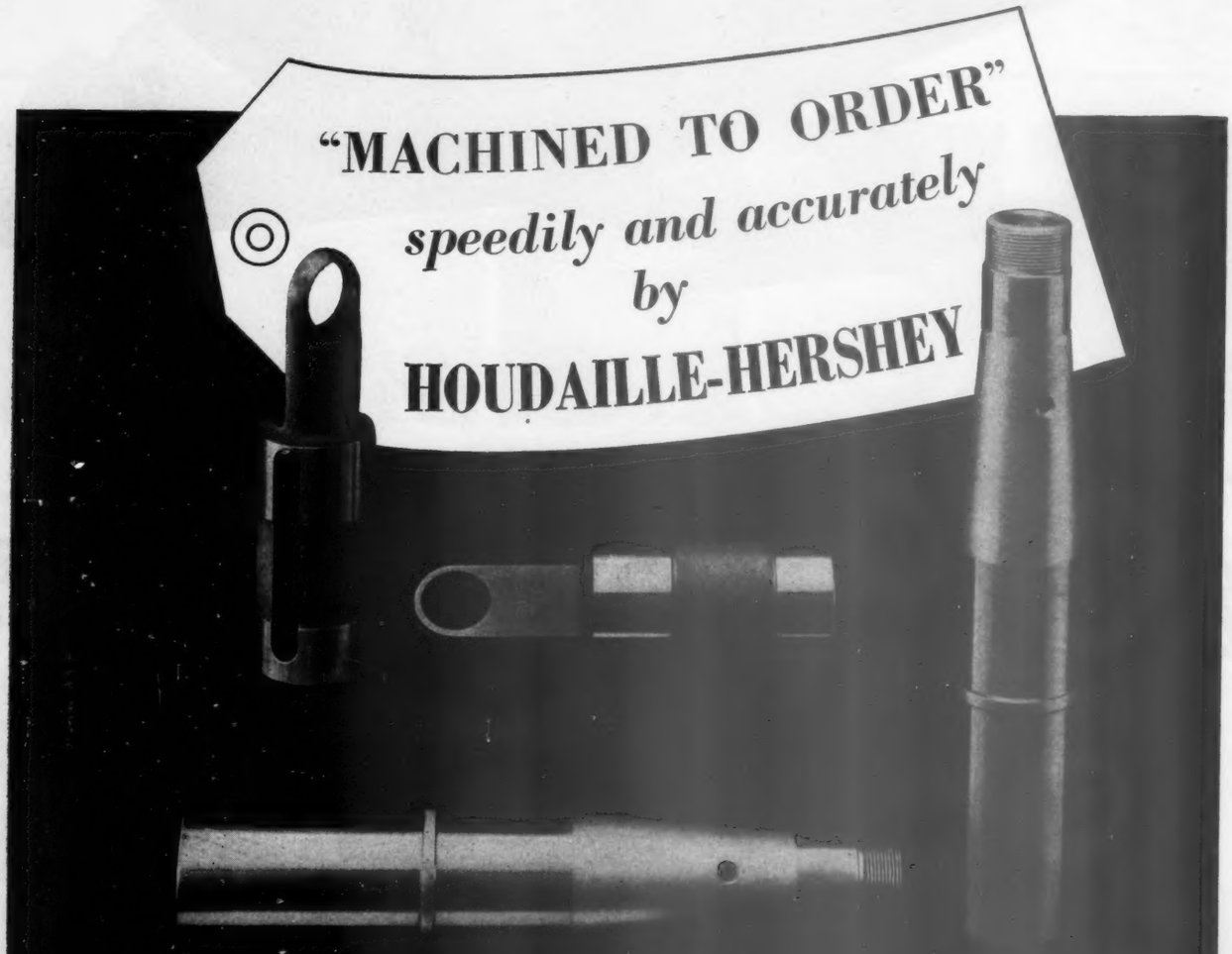

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To the aviation industry, therefore, Houdaille-Hershey's extensive facilities offer skill, speed and accuracy in the manufacture of special parts.

Our Buffalo Division, the Houde Engineering Corporation, gladly will discuss your specific production problems with you.

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Heinze Electric Corporation
Lowell, Mass.

Aviation MANUFACTURING

Fighting Ships Still For Britain

Washington (AVIATION BUREAU): Vast expansion of this country's air forces, particularly as contemplated in the pending $5,000,000,000 appropriation, raises anew the problem of allocation of airplane production as between this country and Britain. Knudsen, of the Defense Commission, Morgenthau, and Purvis of the British Purchasing Commission have been holding a series of conferences on the subject. It is not publicly admitted, but the decision has been reached that most of the actual combat planes will still go abroad, while we will hang on to the training planes. This fits in with our present need, which is to train a big pilot force while capacity for building fleets is created. Of August production, about 236 planes went to the British, while this country took 396—largely trainers. Other countries took 84, which includes deliveries to Norway which went to swell the British air forces. Large commercial planes rounded out an approximate 900 ship production.

British queries to Knudsen as to what they could expect in the way of deliveries additional to present schedules, elicited an estimate that by late 1941 they could get 1,300-1,400 planes a month—indicating that production of actual combat planes, as opposed to trainers, will reach at least that level then. Production of all types, including trainers, is expected to reach 1,500 a month by the end of this year and to reach 3,000 a month by the middle of 1942.

The vital problem of getting enough liquid-cooled engines to power pursuit airplanes is still troublesome. But through personnel changes, elimination of experimentation, and probably some liberalization of specifications it is hoped to improve the situation. July production of Allison engines was about 65, August 130, and it is hoped to reach 400 a month by November. The Rolls Royce which Packard is to build will not be in production for at least ten months. Meanwhile Curtiss P-40s are standing in the yards waiting for engines.

United Aircraft Appoints

Charles J. Marks, Arthur A. Merry, Frederick L. Woodcock have been appointed chief tool engineer respectively for United Aircraft, Pratt & Whitney and Hamilton Standard. Marks has been production engineer with Pratt & Whitney since 1925; Merry assistant production engineer since June; Woodcock in charge of tool designing at Hamilton Standard since 1936.

Unfilled orders of the primary plane producers are steadily rising and are now well over twice the $600,000,000 estimated aggregate backlog at the beginning of the year. Contracts in negotiation under the defense program will increase the grand total by another $400,000,000. For example, the Army Air Corps is understood to be negotiating a large engine order with Curtiss-Wright which would boost the latter's unfilled orders to better than $400,000,000. As it is, Curtiss-Wright's $248,000,000 backlog is slightly in excess of total shipments by all aircraft makers in 1939. The following table gives the latest approximate unfilled orders of fifteen primary companies.

Allison	$40,000,000
Aviation Corp.	12,000,000
Bell	22,000,000
Boeing	90,000,000
Brewster	45,000,000
Consolidated	110,000,000
Curtiss-Wright	248,000,000
Douglas	140,000,000
Grumman	9,000,000
Lockheed	170,000,000
Martin	110,000,000
North American	95,000,000
Republic	12,000,000
United	212,000,000
Vultee	30,000,000
	$1,345,000,000

TWENTY-FIVE YEARS WITH ONE COMPANY (Curtiss Aeroplane Division at Buffalo) earns for design engineer Samuel T. Payne (1). a diamond mounted pin, presented by Burdette S. Wright, vice president of the division. Veteran Payne joined the organization in the bygone "Jenny" days.

EDDIE MOLLOY has assumed the duties of Works Manager for Ryan Aeronautical Co. After 14 years with Curtiss-Wright, Molloy resigned as assistant chief engineer in 1939 to become factory manager at Stinson, from which organization he came direct to Ryan.

Ford's airplane engine, on which he is working independently, will be of about 1,500 hp. and will be based on the design of the Lincoln-Zephyr V-12, it has been announced.

Aero Club of Iran has bought 25 Rearwin Cloudster 120-hp. trainers, and plans are being made to manufacture Cloudsters in Iran.

Vultee, Stinson Merged

Manufacturing facilities, notably the new Nashville plant of the Stinson Division of Aviation Manufacturing Corp., will be more largely devoted to production of military trainers through a re-shuffle of Aviation Corp. subsidiaries under which Vultee Aircraft will take over Stinson. Vultee's entire previous experience has been in the military field.

Stinson's Nashville plant is now devoted to Stinson 105's and a few military trainers. It is planned, under the new arrangement, to triple or quadruple the size of the Nashville plant, somewhat increasing the output of commercial planes and greatly enlarging the trainer output. The old Stinson plant at Wayne, Mich., will be used for parts.

Vultee, until last spring, was wholly owned by Aviation Corp., which also owns Aviation Manufacturing Corp. At that time the Vultee holdings were reduced to 60 percent. The present deal involves an increase in Vultee stock which will result in Aviation Corp. owning about 70 percent of Vultee, directly or through Aviation Manufacturing Corp.

Douglas Aircraft plans to spend $20,000,000 on a huge new plant at Long Beach, Calif., and also make immediate additions to its Santa Monica and El Segundo factories, all of which will accelerate output sufficiently to complete new Army and Navy contracts by April 1, 1942. New machinery for these plants has already been purchased. Donald Douglas, president, stated that this expansion would result in more than doubling present personnel and payrolls. The company now pays 18,000 employees more than $18,000,000 annually.

Romec Pump Co., now out of bankruptcy, plans to increase its output of aircraft pumps and also expand into other pump-using industries.

A new plane manufacturer. Tucker Aircraft Corp., has been organized in Detroit with Preston Tucker as president. The company, which is also interested in combat cars and tanks, is organizing an aircraft design department headed by Arthur C. Lardon.

Consolidated Expands

Editor's Note: the following summary of Consolidated's readiness to do its part in the national defense movement was received too late to be published last month with the statements of other manufacturers.

"Consolidated Aircraft Corp.'s position relative to the President's recently announced national defense program calling for 50,000 plane output per

Major Fleet

year, is one of timely alignment. Our present expansion program by which our factory is being doubled, was already under way before the announcement. Completed, this expansion will give us 1,910,000 sq.ft. of covered and uncovered manufacturing space, making it, I believe, the largest integrated aircraft manufacturing plant in America, and we have an option on additional land adjacent, equal to 50 percent of this area, with plans practically complete for its possible improvement. We have a factory of our own, a good organization—equal to any in our industry—the best in our history, and no mortgage on our premises or our future."—Maj. Reuben H. Fleet, president and manager, Consolidated Aircraft Corp.

West Coast News

Aircraft Parts Manufacturing Association has been formed in Los Angeles, Calif., for the purpose of collecting, analyzing, and distributing information of interest to its members, particularly relating to problems arising through the enactment of new legislation affecting subcontractors and aircraft parts suppliers. Membership includes California companies engaged in manufacturing or processing parts, accessories, or products used in the aircraft industry. Jack Frost, former secretary to Major R. H. Fleet, Consolidated Aircraft Corp., is serving as executive secretary of the new association.

An important addition to the Southern California aircraft accessory industry is the Swedlow Aeroplastic Corporation, Glendale, Calif., formed by a group of aviation industry executives to promote the manufacture of acrylic resin plastic parts as a substitute for glass in aircraft. The company fabricates, molds, and forms these plastics into various shapes. Officers and directors of the company read like a Who's Who of aviation people. Dave Swedlow is president; Lawrence Green, secretary and treasurer, and Hall L. Hibbard, vice-president. The above named officers also serve as directors plus the following directors: Wolfgang B. Klemperer, Douglas engineer and president of the Southern California Soaring Association; Richard W. Millar, president of Vultee Aircraft, Inc.; John K. Northrop, president of Northrop Aircraft, Inc.; Charles H. Van Dusen, vice-president and works manager of Consolidated Aircraft Corp.

Newest aircraft manufacturer to tackle the plastic problem is Twentieth Century Aircraft, Inc., Los Angeles, formed by William Schoenfeldt, Keith Rider, Roscoe Turner, and others, to develop a wood-plastic single-engine pursuit plane. A building has been leased in the Los Angeles industrial district, and construction of the prototype plane is underway.

Ford Offered P & W License

Pratt & Whitney Aircraft has offered the Ford Motor Company a licensing agreement, by which Ford could produce P & W double-row Wasps. After a meeting between officials of the two concerns, Frederick B. Rentschler, chairman of United Aircraft, announced there had been "a substantial meeting of minds."

At this writing Ford has not signed a contract, but indications are that the deal will go through. Ford is to pay P & W one dollar per engine as a licensing fee, despite heavy engineering costs sustained by the latter. Exact number of engines is not announced, but tooling will probably be on the basis of 4,000.

Allison Engines is apparently contemplating new Army orders as it is buying tools for plant expansion.

Manufacturers Not At Fault For Delay

Testimony of top-ranking Army officials before the Senate Appropriations Committee absolved aircraft manufacturers from blame for the delay in signing national defense contracts.

Although General Arnold, Chief of the Air Corps, was correctly quoted as saying "They have got us stymied at this minute," he also said, "They are naturally hesitant about going ahead. Some of them just through patriotism and in spite of the fact that they do not have orders, have put in raw materials and started the manufacture of jigs and dies. . . . I think the industry is ready to go ahead when this is straightened out. . . ."

Brig. Gen. George H. Brett testified that "the industry has always played ball with the government and they have lost money in doing it at times."

Practical problems faced by the industry, such as reduced Vinson-Trammell profit limitations, amortization, taxes, uncertainties as to labor and material costs, and similar headaches, were thoroughly aired in Committee.

Sub-contractors, however were charged with refusing to work for aircraft companies under the profit limit in favor of other industries where no curtailment of profits is applied.

Northrup began production last month on the first patrol bomber in its Norwegian order five months after the firm moved into its new plant at Hawthorne, Calif., and began designing the ship.

Location of Plants

The War Department's ideas on location of munitions and airplane plants for expansion may never become fixed and definite, but may remain only a policy, subject to variations. The political pull of localities may prove too strong to be completely ignored.

Right now, the high command wants to put all new plants between the Rocky and Appalachian Mountains and not closer than 200 miles of the north and south borders. But both coasts are screaming murder. The advantages of industrial concentrations on the coasts will be sacrificed to safety from attack, if War Department carries out its plan.

Pacific coast cities seem most likely to succeed in side-stepping in the "inland" plan, since they are farther removed.

Menasco Speeds Production

Editor's Note: the following statement by the president of the Menasco Manufacturing Co. was received too late to be published last month with the statements of other manufacturers.

"Plans are under way at the present time whereby we can furnish four complete training

A. E. Shelton

engines per working day, starting in the fall. This takes into consideration the new plant facilities which will be available in Burbank in early September. It will be possible, by going three shifts and working overtime, to go to approximately 100 engines per month with present equipment and the expanded facilities now being provided for.

"In the event there is a need for additional engines, we will have plenty of available ground space to further expand and thus it becomes only a problem of obtaining the necessary additional machine tools to provide whatever quantities of engines may be necessary. We have no fears of not being able to meet the emergency."—A. E. Shelton, president, Menasco Manufacturing Co.

Stearman Deliveries

Stearman Division of Boeing is delivering PT-18 primary trainers to the Air Corps for training cadets. It is a biplane powered with 225 hp. R-755-7 Jacobs engine, seven-cylinder. Fuselage is steel tubing with fabric cover; wing, wood spar and wood and metal braced with fabric cover. Landing gear is fixed cantilever. Cockpits are open. Weight 2685.5 lb.; wingspan 32 ft. 2 in., length 25 ft., height 9 ft. 8½ in., chord 6 ft. These deliveries are to meet the expansion program.

DESPATCH STREAMLINED Furnaces and Ovens

Despatch Streamlined Finish Baking Oven Recently Installed in a Large Aircraft Plant

for the Aircraft Industry

Despatch is doing for the Aircraft Industry what it has done for 38 years in other industries.

Such plants as Allison Engineering Co., Indianapolis, Ind.; Timm Aircraft, Van Nuys, Calif.; Curtiss Aeroplane Division, Buffalo, N. Y.; Ken Royce Aircraft Engine Co., Cincinnati, Ohio; Grumman Aircraft Engineering Corp., Long Island, N. Y., etc., are Despatch equipped.

DESPATCH BUILT

OVENS For Finish Baking; For Core Baking; For heating before leak testing; For shrinking valve seats and bushings; For baking coils and armatures; For plastic baking and curing.

FURNACES For Dural sheets and shapes; For aluminum alloy tubing and parts; For aluminum alloy castings and rivets; For tempering tools and dies; For tempering and drawing engine parts.

Write for complete details

DESPATCH OVEN COMPANY
636 Ninth St. S. E.
MINNEAPOLIS, MINN.

OVENS—DRYERS—FURNACES—AIR HEATERS

Building Program

(*Continued from p. 69*)

ahead, but the industry was still divided on the wisdom of this course. Three weeks later the decision was reached.

An exception to the limitation to present capacity was Douglas—all along a leader in the group which wanted to play ball with the administration. Douglas announced plans for a $20,000,000 plant expansion.

The Senate Appropriations Committee shortly thereafter approved the House-passed second Supplemental Defense Appropriation, adding $34,507,320 to bring the bill up to the gigantic total of $5,008,169,277 including funds for 19,000 new Army and Navy planes, the largest single appropriation in history for this purpose.

Production of these planes, however, entailing generous expansion of manufacturing facilities, is expected to await clearance of the tax measure. Meanwhile, the bill restored the Vinson-Trammell 12 percent profit limit on aircraft—cut in an earlier law to 8—until the excess-profits bill becomes law.

Of the new money added by the Senate Committee, a major portion is allocated for various aviation purposes, including $7,000,000 in cash and $15,000,000 in contract authority for armor, bombs, pyrotechnics and other equipment for Naval aircraft; $10,000,000 for outfits for aviation cadets and bachelor officers at Naval air stations; $7,500,000 in cash and contract authority for the storage of Army and Navy aviation gasoline. A fund of $1,000,000 is earmarked for purchase of Navy non-rigid lighter-than-air craft.

Congress meanwhile moved toward enactment of the bill extending the lending authority of the Export-Import Bank, including power to advance credit to South American countries for military as well as civil aircraft. A new defense measure allowing the President to requisition airplanes, machine tools and other defense materials produced for foreign buyers but denied export by the State Department also started on its way through the House.

Towards the end of the month, Defense Commissioner Knudsen and General Arnold, Chief of the Army Air Corps, made a rapid inspection of aircraft plants and air bases, while four members of the House appropriations military subcommittee began an air tour covering a large slice of the United States and Alaska.

Spot Checking

Army has revealed figures on the Douglas B-19, huge bomber that has attracted so much interest for several years. Power will be by four 2,000 hp. engines. Wing spread 212 feet. Length 112 feet. Capacity, 11,000 gal. of gasoline. Range: New York to Europe and back to California.

Through transcontinental sleeping service has been established on United Air Lines and Western Air Express between the East and Los Angeles.

New Lockheed interceptor travels 460 m.p.h. at two-thirds throttle and 500 wide open. Range is 1100 miles. Climbing speed 4,000 ft. per minute. The Air Corps is interested.

Massive wing of the Douglas B-19 bomber, showing engine nacelles and portion of the fuselage. Wing spread is 212 ft.

Aviation ENGINEERING

Pratt & Whitney Celebrates Its 15th Anniversary

On August 1, the Pratt & Whitney Aircraft Division of the United Aircraft Corp. completed its 15th year of successful operation. No one in the industry need be reminded of the tremendous contributions that this company has made to aviation during that time and to its rapid growth which has brought it to one of the largest manufacturing units of today.

The company started in 1925 when three men—F. D. Rentschler, G. L. Brown and G. J. Meade—first met, designed and constructed a 400-hp. radial air-cooled, aircraft engine for the Bureau of Aeronautics of the U. S. Navy. With a manufacturing staff of 25 persons, it began work in an unused section of the Pratt & Whitney machine tool factory at Hartford, Conn. This engine was the first of the famous "Wasp" series and was one of the biggest single contributions ever made to the aircraft engine field. Following the successful operation of this first engine, the Navy ordered six experimental units and soon followed with an order for 200.

By 1930 other aviation firms had joined with Pratt & Whitney into what now constitutes the United Aircraft Corporation, and at that time the first building of their present huge factory at East Hartford, Conn. had just been completed. This structure covered 400,000 sq.ft. of floor space and employed 1,300 workers. At present the Pratt & Whitney plant covers more than a million and a quarter square feet of area and employs over 10,000 men and women daily in three regular shifts.

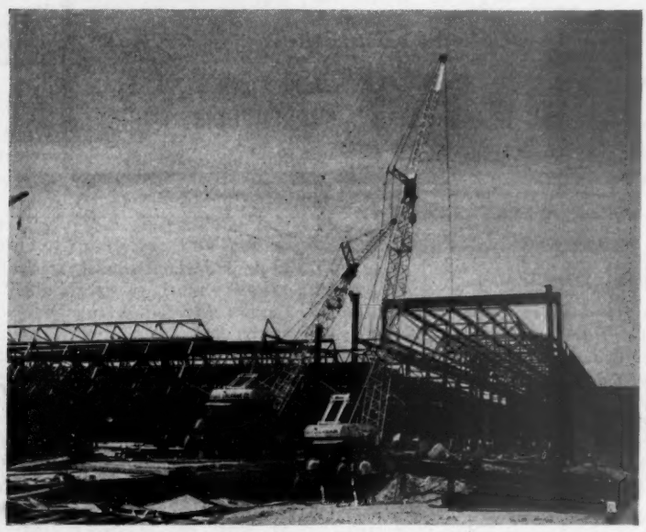
Tracing its development still further, we find that in 1929 they had produced the first successful 14-cylinder, twin-row, air-cooled engine in America, known as the Twin Wasp and its brother the Twin Wasp, Jr. The horsepower of these 14-cylinder engines was increased until in the 1930's the 1400 hp. twin Hornet was developed. In 1939 came another important step in engine design when P. & W. completed the development of the new 18-cylinder, twin-row engine, known as the Double Wasp. After completion of this development, this engine was rated at 1850 hp., but has since been increased (the figures being withheld by the Army).

Early in 1939 Pratt & Whitney Aircraft expanded to include a 100,000 sq.ft. factory adjacent to its own as additional production capacity needs were foreseen. When Allied demands supplemented those of our own country, a factory addition was erected — which brought the production of Pratt & Whitney engines to 850,000 hp. a month. Construction of this factory was undertaken at such a pace that the first machines were in operation three months after the ground was broken in October, 1939.

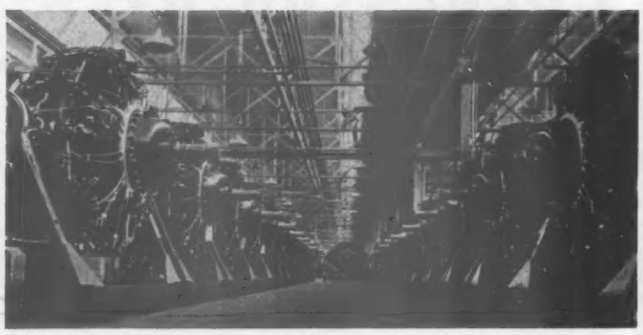
With their important participation in the National Defense Program, expansion plans

(Turn to page 87)

NIGHT VIEW OF THE PRESENT PRATT & WHITNEY PLANT which now has over a half million square feet and some 25 acres. New addition under construction adds 50 per cent floor space.



THE NEW CONSTRUCTION now being built will be finished in a few months and production going by the first of the year.



DOWN THE ASSEMBLY LINE showing a line of 1200 horsepower engines ready to be shipped out after their test run.

A more detailed story of the recent affiliation of the Pratt & Whitney Aircraft Division of the United Aircraft Corporation is given in other parts of this News Section. When the joining of the two companies for defense needs was being contemplated, officials from the Ford Motor Company visited Pratt & Whitney to look over the facilities and make licensing arrangements. Upon the return of Charles M. Sorensen, General Manager of Ford Motors, he was highly impressed with what he had seen in his visit. His remarks were as follows:

*"From our observations we found that the production of Pratt & Whitney engines fits in perfectly with our production and we will inform the government that we will accept a contract. * * * We greatly appreciate the cooperation received at United Aircraft. I never saw such an accomplishment in plant facilities as United Aircraft presents. I did not realize such a stupendous job could be done in such a short time. I don't believe the people appreciate what has been accomplished. Our visit was a remarkable demonstration of the cooperative policy of United Aircraft and this is also apparent in the United Aircraft services to the government. United Aircraft has a great organization."*

TO *Produce* TAKES *Background*

Pouring Molten Alcoa Aluminum into a mold from which will emerge one of the famous thin-finned cylinder heads used on American aircraft engines.

In three great plants scenes like that in the illustration above are taking place, as Alcoa Aluminum flows into the sand molds to make parts used by the aircraft industry. The most familiar of these parts is the thin-finned cylinder head, but equally essential are scores of small fittings and other parts, all notable because they are turned out in quantity with skill which makes them strong and reliable.

Finished cylinder head: note fins, 5 to the inch, 1¼" deep.

The background of this foundry operation is many years of painstaking, unremitting development. The whole technique of making the thin, closely-spaced fins of the cylinder head had to be originated for the purpose, then adapted to a mass production method. To improve foundry practice and the finished product, in the case of these and other Alcoa Aluminum castings, the use of the X-ray as a foundry tool was pioneered. Other avenues of progress have covered mold design, temperature control, atmosphere control, and development of alloys.

Once developed, this knowledge and skill has been disseminated, and is being used by other manufacturers who cast Aluminum Alloys into parts essential to aircraft production.

Scores of other parts are produced by casting Alcoa Aluminum Alloys in sand. Illustrated above is a landing wheel.

This demonstrates again how there has been more than genial willingness, there has been a hard-headed program consistently followed to provide the aircraft industry with the products it needs made from Alcoa Aluminum Alloys. That program has contributed to the readiness of the industry for mass production. ALUMINUM COMPANY OF AMERICA, 2182 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA ALUMINUM

The Birdmen's Perch

For several years now, we've been printing a trick math problem in each issue of the Perch. Some have been sent in by contribs whose names we wish we could print in gold. Most of 'em we've had to dig up ourselves—an increasingly tough chore. If you know a sticker, please shoot it at us. If we can use it, we'll print your name . . . in boldface, black type, anyway.

Major Al Williams, alias "Tattered Wing-Tips," Mgr., Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

NEW BUSINESS DEPT.

Not long ago, we saw a whole collection of Navy Aircraft Insignia. At least half of which—though we've seen them a hundred times—drew a smile from us for their cleverness.

Come to think of it, there are some pretty fine private plane insignia, too. Some of which might be interesting enough to reproduce in the Perch. If you know of any . . . or have any ideas, send them along with permission to print. Doesn't make any difference how rough your drawing is, our artist will take off the jagged edges.

KEEP IT CLEAN

The gent waving the admonitory (how-zat?) finger isn't cautioning the other lad to raise the moral altitude of his jokes.

What he's doing is stressing how important it is to use an oil in your engine that *stays* clean. Yes, sir, whether you're telling jokes in mixed company or pouring oil into your engine, "keep it clean" is a pretty good rule to remember.

You see, Gulfpride follows that "keep clean" rule because it's been cleaned up *before* it goes into your engine! You know what an awful beating oil has to take in an engine. Sometimes it just can't help breaking down a bit. And every oil contains gum-and-sludge-formers that cause trouble when the oil begins to break down.

We've licked that problem to a great extent. First, because Gulfpride Oil is hard to break down. And second, because the exclusive Alchlor process, by which Gulfpride is refined, has *removed* up to 20% more carbon, varnish, and sludge-formers. Gulfpride Oil *starts out* cleaner . . . and *stays* cleaner!

FOG-BOUND

A pilot we know found himself grounded in a deserted, emergency landing field. He had with him exactly 1 4/5 packs of regulation-size cigarettes.

Waiting for the weather, he not only smoked the whole initial supply but also pieced together the butts with cigarette paper, finding that he could make a complete cigarette out of every half-dozen ends.

Before the sun shone again, he'd finished 'em all. How many cigarettes did he smoke?

(Think you know the answer? We'll bet you miss it, as we did. Send your figure to T.W.T. to be checked. We'll get the official version out by return mail.)

THIS MONTH'S WHOPPER

Dear Major:

Here's my Doctor's Thesis for the Whopper Diploma, and, if every word of it isn't true, then I'm a suck-egg liar.

Last year I'm doing a little barnstorming through the corn country, and, frankly, business didn't exactly boom. The local sports stood around my plane, starin' and spittin' tobacco juice at her, but they just weren't buying!

"C'mon, boys," I says, "this one is on me. Step right in an' experience all the thrills of flyin' like a bir-r-r-r-d!" After that one had sunk in for about ten minutes, a lad stepped up, bobbed his Adam's Apple at me a couple of times, and said, "Shucks, Mister, I don't care if I do."

Now there may be taller, leaner lads than my new customer, but if there are I don't know where to find them.

Well, I check to see that my tank is full of good Ol' G.A.G., an' off we start. I figure I'll give this fellow a run for his money, so after gainin' a little altitude, I try an Immelman. It was a good Immelman, understand, but somethin' wasn't just right. There was a drag to her I never experienced before with G.A.G. in the tank!

I'm gettin' a little discouraged at this point so I decide to land. I look around to see how my passenger's makin' out. Darned if he didn't have one of his long legs over the side, draggin' his size-14 foot on the ground!

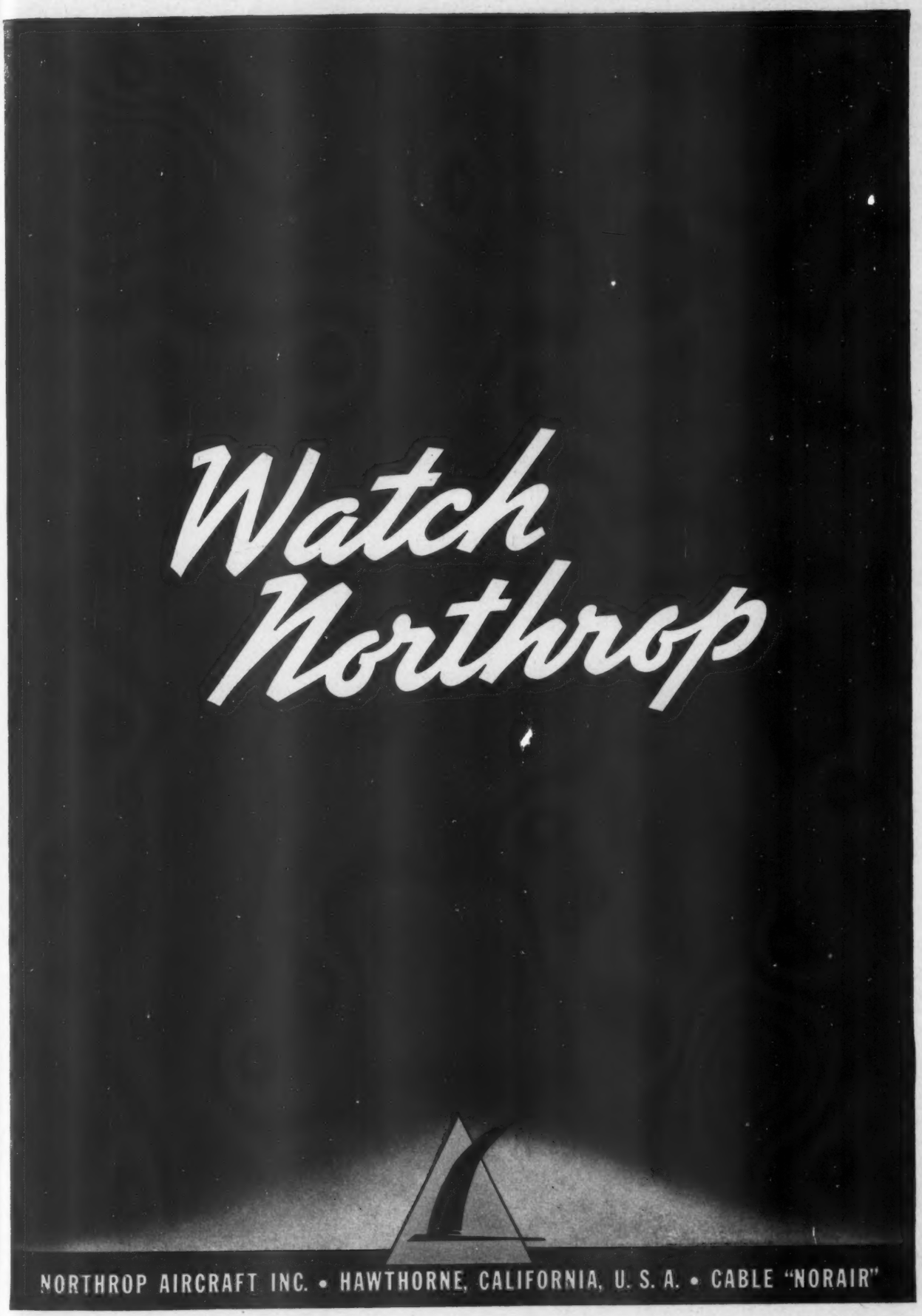
Well, I take my goggles off and sigh a long sigh. "Look, brother," I says to him, "I don't want to seem inquisitive, but you been draggin' one foot on the ground?" "Yep," he answers, "I sure have, all the time we been up there. I never rid in one of these contraptions before an' I ain't takin' chances. I ain't no fule!"

An' just to think—all the time I was suspectin' that G.A.G. I should have known better!

Jim Norris

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF **GULF AVIATION PRODUCTS**


Watch
Northrop
NORTHROP AIRCRAFT INC. • HAWTHORNE, CALIFORNIA, U. S. A. • CABLE "NORAIR"

MEN and MACHINES

Alfred Ziegler Working On the Draw Bench

AMERICA'S "Men and Machines" are definitely meeting the tremendous demands that have been so suddenly placed upon them. Fleetwings' workers, many of whom are skilled in the operation of special machines designed by Fleetwings' engineers, are loyally contributing to our ever increasing National strength in the production of Stainless Steel and Aluminum Alloy Fixed and Movable Surfaces for the aviation industry.

In addition, Fleetwings' greatly enlarged facilities are now geared to meet on a mass production basis, the exacting standards of precision specifications for Stainless Steel and Aluminum Alloy Parts and Fixtures, as well as Hydraulic Valve Equipment.

DESIGN
ENGINEERING
FABRICATION

FLEETWINGS
INCORPORATED
BRISTOL PENNA.

are still in progress. A little over a month ago, work was begun on still another plant addition which is designed to increase Pratt & Whitney's monthly engine output to 1,200,000 hp. With such an outstanding and well earned record we wish Pratt & Whitney at least as much success for the years to come and congratulate them again on their valuable contribution to aviation in the past.

Recent Awards

Navy Department

Pioneer Instrument, Bendix, N. J., $154,250 for aircraft compasses.

Grumman Aircraft Engineering Corp., Bethpage, N. Y., $7,260,280 for airplanes.

The Electric Auto-Lite Co., La-Crosse, Wisc., $46,200 for units, engine gage, aircraft.

Grumman Aircraft Engineering Corp., Bethpage, N. Y., $694,700 for airplanes.

Pioneer Instrument Div. of Bendix, Bendix, N. J., $73,500 for gages, manifold pressure.

Palmer Scott & Co., Inc., New Bedford, Mass., $74,728 for boats, aircraft rescue.

War Department

The Leece-Neville Co., Cleveland, Ohio, $217,420 for airplane parts.

The Republic Aviation Corp., Farmingdale, N. Y., $114,636 for airplane parts.

Bendix Aviation Corp., Bendix, N. J., $24,567 for airplane parts.

Continental Motors Corp., Detroit, Michigan, $1,090,894 for engines.

Fairchild Engine & Airplane Corp., Hagerstown, Md., $1,038,300 for 100 training planes.

Consolidated Aircraft Corp., San Diego, Calif., $14,861,342 for 56 4-engines bombing planes.

Beech Aircraft Corp., Wichita, Kansas, $3,410,746 for 67 training airplanes.

Stearman Aircraft Division, Boeing Airplane Co., Wichita, Kansas, $2,041,947 for 337 training airplanes.

North American Aviation, Inc., Inglewood, Calif., $11,335,681 for 700 airplanes.

Bendix Aviation Corp., Elmira, N. Y., $2,545,000 for aircraft weapons.

Fairchild Aviation Corp., Jamaica, N. Y., $468,757 for aircraft cameras.

General Bronze Corp., Long Island, N. Y., $54,652 for propeller dolly assemblies.

Bendix Aviation Corp., Bendix, N. J., $50,000 for drift meter assemblies.

Bendix Aviation Corp., South Bend, Indiana, $41,454 for wheel and brake assemblies.

Bendix Aviation Corp., Bendix, N. J., $620,549 for starter assemblies, switches, etc.

United Aircraft Corp., East Hartford, Conn., $188,055 for propeller assemblies and controls.

Hayes Industries, Inc., Jackson, Michigan, $227,737 for wheel and brake assemblies.

Curtiss-Wright Corp., Clifton, N. J., $429,400 for propeller assemblies and sets of controls.

Cessna Aircraft Co., Wichita, Kansas, $900,378 for AT-8 airplanes.

Steam Airplane?

Washington (AVIATION BUREAU) Renewed attempt to interest the military in a steam engine for airplanes will be made in a few months, rumor here has it. The engine, a turbine, is reported neatly streamlined, noiseless, developing 3,000 to 5,000 hp. Langley's first airplane was steam-driven, and the idea has been borrowed ever since. Germans are reported using steam now.

Last attempt to interest the Army was made about six years ago by LaMont, inventor of the high-pressure marine boiler used by Japs and Germans. He had a central boiler in the fuselage with two 18x36-in. turbines in the wings developing 1,500 hp. each; condensor, with 21 in. of vacuum, was behind the propeller. Air Corps was afraid of the condensing system and turned down the idea. The Besler brothers made several flights in a steam-powered plane in California a number of years ago.

British Combine

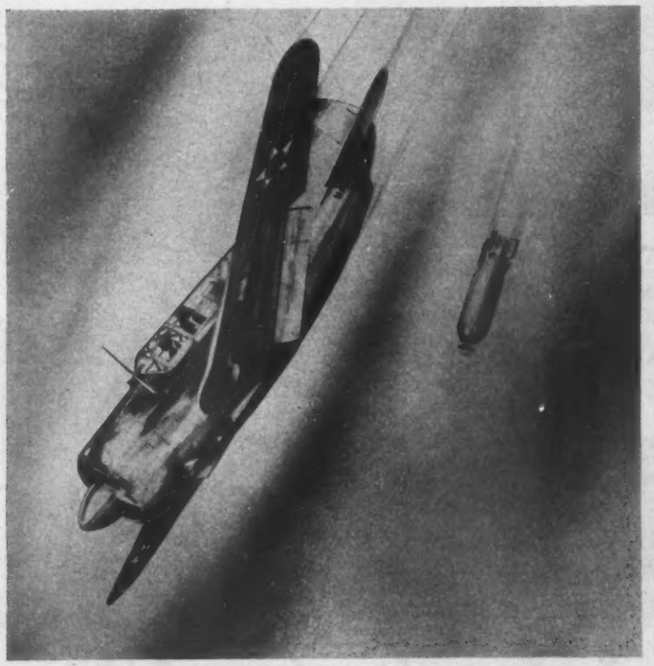
British gunner becoming familiar with operation of a hydraulically operated gun turret at R.A.F. gunnery and bombing school.

X-Ray Testing Machine

Installation of a new, fully automatic X-ray machine that will photograph 5,000 average parts per day has been completed at the Triplett & Barton laboratories in the Lockheed factory, Burbank, Calif. Representing more than four years of development work, the machine represents a complete departure from previous equipment. All of the high-voltage X-ray equipment is housed in a cabinet 10 ft. high and 4 ft. square. Beneath the cabinet is a conveyor table that works in shuttle fashion from side to side. The cabinet and table are lined with 1,500 lb. of lead to shield the operator from the X-rays, enabling him to work alongside the cabinet while photographing is in progress.

The portion of the cabinet housing the X-ray tube and transformer works on an automatically controlled electric lift that raises it above the table on which the parts are placed. When the photographic control is turned on the cabinet is lowered in place and held there until the picture is made.

TRIPLETT & BARTON high speed automatic production X-ray machine now in operation at Lockheed Aircraft Corporation, Burbank.

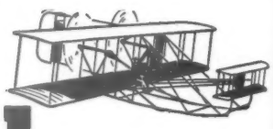


Artist's drawing of the new Curtiss XSB2C-1 dive bomber being built in Buffalo for the Navy for use as a shipboard bomber. New ship is said to set new standards by having unusually heavy fire power, increased bomb capacity and fine performance. Engine is a 1,700 hp. Wright double-row Cyclone with fourteen cylinders.

Helium for Defense

The government's helium plant at Amarillo, Tex., has completed production of 100,000,000 cu. ft. of gas, the Interior Department announces. Helium will be used in new lighter-than-air equipment to be built for Army and Navy, and Secretary Harold L. Ickes, of Interior, says he is ready to meet any defense demand. The Amarillo plant has produced 100,012,000 cu. ft. in the 11 years of its existence, but operated at full capacity, it could turn out twice that much. The cost is just under 1½c. per cu. ft. Helium is used for many other purposes than floating gas bags. The United States has a complete monopoly. Helium authorities in Washington say Germany's claim that sources had been discovered there are "hooey."

From the days of the "Pusher"



Curtiss and Goodrich Have Worked Together

☆

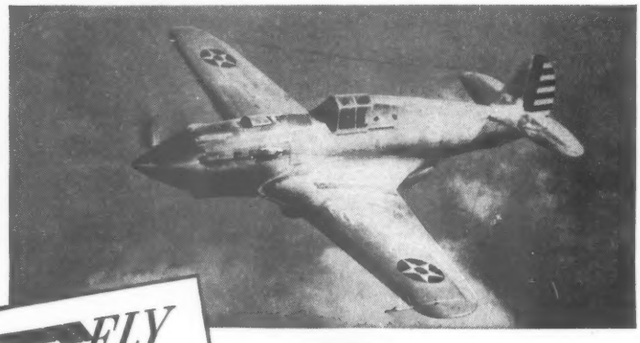
● When Glenn H. Curtiss won the International Cup Race at Rheims, France, in 1909, his "pusher" was equipped with Goodrich Tires.

It was the beginning of a long association between Goodrich and the organizations that later bore the Curtiss name. As aviation took shape and grew, Curtiss developments continued to have far-reaching effects upon aviation's progress. Together Curtiss planes and Goodrich Aviation Products became veterans of many of the world's most important flights.

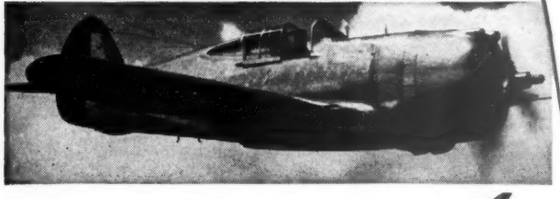
And today . . . 31 years later . . . Curtiss planes of many sizes and types come from production lines where many Goodrich Aviation Products are built into them.

Just as the expanding needs of aviation have increased the sizes and types of planes, these needs have increased the range of Goodrich Aviation Products. Where once there were only Goodrich Airplane Tires, there are now Goodrich DE-ICERS . . . Goodrich E.T.* Brakes and over 40 other Goodrich rubber products to meet the demands of aviation. Write The B. F. Goodrich Co., Aeronautical Div., Akron, O., for information.

*Goodrich Expander Tube Brakes are manufactured under license and sold by Hayes Industries, Inc., Jackson, Mich., and Bendix Aviation Corp., South Bend, Ind.



● Aggressive, high-speed units built by Curtiss are today in the forefront of American defense. As with many of their predecessors, Goodrich Airplane Silvertowns give these planes extra protection where take-offs and landings must have "split-second" accuracy.



IT PAYS TO **FLY**

and it pays to take off and land on Goodrich Airplane Silvertowns >>>>> the safest airplane tires ever built

Goodrich *Airplane* Silvertowns

THE SAFEST AIRPLANE TIRES EVER BUILT

Over 40 Rubber Products for Airplanes — including Tires — Tail Wheels — Abrasion Shoes — DE-ICERS — Matting — Rubber Hose — Grommets — Shock Absorber Cord — A Complete Line of Rubber Aeronautical Accessories.

CURTISS XSB2C-1 DIVE-BOMBER

The Curtiss XSB2C-1 Dive-Bomber, developed jointly by the United States Navy and the Curtiss Aeroplane Division, Curtiss-Wright Corporation, offers performance and versatility never heretofore achieved in aircraft of its type. In addition to armament for its own defense, this new weapon is capable of carrying increased bomb loads and heavy fire power—at high speed over a great distance—for making an attack with deadly striking power.

The XSB2C-1 is equipped with a Wright Double-Row Cyclone 14-cylinder engine. Now nearing completion, it will soon be in the hands of the Naval Trial Board and will offer new offensive power to the Navy when operated with carrier squadrons of the U. S. Fleet.

CURTISS AEROPLANE DIVISION
CURTISS-WRIGHT CORPORATION
Buffalo New York
"The Pioneers of Aviation"

Curtiss PRECISION-BUILT ARMY AND NAVY AIRCRAFT

TRANSPORT Aviation

1½ Years of Safety

On September 26, if Providence please, the airlines will have completed a year and a half of no-serious-accident flying. Since March 26, 1939, date of last accident, they have flown 1¼ billion miles, carried 3,158,159 passengers without injury. Most people are tired of reading astronomical airline statistics, but the passenger list of July reached 296,453 as compared with 150,102 last January. During the 12 months ended April 30, domestic carriers increased their net revenue from only $14,425 in the preceding 12-month period to $5,429,029. Total operating revenue increased 34%. But the significant thing was that while passenger revenue showed an increase of 51% it also accounted for 85% of the increase of the total revenue. Mail revenue was 11.37% higher. Speaking of safety again, Jerome Lederer, director of the re-organized safety Bureau, says that instead of relaxing on their good record, the airlines are still breaking records by careful selection and training of personnel, by working hard on airworthiness of equipment, and by prudent operation.

Acme

British flying boat Clare landing at the international seaplane base, La Guardia Field, after its first trip. War or no war, Britain intends to maintain her commercial flying. Mail only was carried, no passengers yet.

PCA Traffic Reaches High

PITTSBURGH—For the fifth consecutive month PCA set a new revenue passenger traffic record, flying 23,245 passengers 4,115,946 passenger - revenue - miles, Edward Sullivan general traffic manager for Pennsylvania-Central Airlines announced.

The mileage shows a 105.74 percent increase over 2,000,578 revenue-passenger-miles flown in July 1939. Passenger revenue increase gained 102.27 percent over 11,492 passengers carried in July 1939.

July's record also raised the June, 1940 revenue passenger record by 7.06 percent. During the past seven months PCA has flown 75.68 percent more passengers and 80.14 percent more passenger-miles than in the same period in 1939.

Pick-up Flies Again

All-American Aviation's mail pick-up-and-drop system now has a permanent certificate from CAB on mail and express for a re-organized system of five runs, including about 86 cities, as compared with about 52 cities under the old Post Office authorization. Three of the five routes are in operation, and the other two will start in about 60 days. The company is facing some delay in getting additional equipment. It is flying Stinson single-engine SR10Cs.

The company asked for authority to carry passengers on the Cleveland-Pittsburg section, but CAB dismissed the application without prejudice, so that AAA can apply again. Apparently there was no question of safety involved. A couple of other operators in the region intervened, anticipating that AAA might eventually establish through service which would constitute unjustified competition. But AAA feels it has covered that objection in its application.

The pick-up service was grounded exactly three months, awaiting action by CAB. During that time the staff was held intact under salary at a cost of about $12,000 per month.

20 Hours to Cristobal

Cristobal will be only 20 hours from New York when Pan America's new fast schedules start on September 1. Countries of the Western half of South America will be 24 hours closer to the United States. U. S. mail, passengers, express will go to the Argentine in only 3¾ days as against 4¾ days on the old schedule. A single 7-hour flight by new stratoclipper spans the distance between Miami and the Canal.

The PAA trip between Buenos Aires is 6,500 miles and the 3¾-day time is the world's fastest on so long a run.

PAA, PAA-Grace, and Panama Airways (PAA's transisthmian Canal trip) got "grandfather" certificates from Civil Aeronautics Board. These certificates to PAA and domestic lines have cost huge sums in lawyers' gab time and have held up other CAA work vital to air progress, say critics. CAA can give you good reasons for all the red tape, but others say the certificates were about like notifying Willkie that he had been nominated.

PAA made its 200th transatlantic crossing, which would have called for fanfare in more festive times. The three clippers on that run have logged ¾ million miles, carried 2,764 passengers. Read Van Dusen's "Dear Senior" letter of Aug. 5 for a dandy story of an engine failure (1 of 4) and a turnaround 800 miles out, and how passenger list reflects conditions in Europe.

Atlantic Ltd Gets Permit

CAB transferred to Airways Atlantic Limited the transatlantic permit formerly held by Imperial Airways. All British oversea airlines are now reorganized under British Oversea Airways Corp., the apparent purpose being unit management under the present emergency. The original permit to Imperial was issued by CAA in June 1939 in substitution for a prior permit issued by the Bureau of Air Commerce in 1936, in accordance with a reciprocal agreement between the U. S. and Britain. The Airways Atlantic Ltd. permit authorizes flying between United Kingdom and Ireland and the United States via Canada and Newfoundland. The British are now operating about one trip a week, ostensibly exploratory, but actually to augment communications with this country, since Pan American service is indirect (to Portugal).

FOR FIFTEEN CONSECUTIVE YEARS of service with American Airlines and its predecessors, George Rutledge (r.) receives a gold watch from Ralph S. Damon, vice president in charge of operations. Rutledge, who is American's first 15-year man, is in the line's stations department at LaGuardia Field.

Air Weather Men

One hundred recruits for training as aviation weather service experts are being rounded up by the Administrator of civil aeronautics, in cooperation with the U. S. Weather Bureau. You will recall that Weather was transferred in the government reorganization act from the Department of Agriculture to Commerce, because weather had become more important to commerce than it is to agriculture. Money will be provided by the Civil Pilot Training Program for training the 100 weather men, who are regarded essential to the defense program, and the Weather Bureau will prescribe the qualifications of trainees and provide the course of study.

These weather courses will be given at MIT, California Tech., U. of C at Los Angeles, U. of Chicago, and N. Y. U. Applicants must have completed CAA pilot course, have four years of college.

Airline Profit Limit

Complete exemption for the airlines from the new excess-profits tax bill was urged upon Congress by the Air Transport Association, which told the Congressional Committee drafting the measure that the Civil Aeronautics Board regulates air carrier income in such a way as to permit no more than normal profits.

"Since the CAB does not permit one penny more income than is necessary," Col. Edgar S. Gorrell testified, "there is no purpose served by applying an excess-profits tax. They are bound to come into conflict in some or all cases."

UNITED AIR LINES also marks the first person to serve it and its predecessors for 15 successive years. He is Charles T. Wrightson, Burbank operations manager.

AIR TRANSPORT INDICATOR

August 1, 1940

150.0

Which is the ratio of passenger-miles reported by the Air Transport Association for all domestic lines for July, 1940, to the figure for July, 1939. Total for the indicator has fallen back considerably due to the big increase a year ago. For the first seven months of 1940 traffic stood at 555,159,270, revenue passenger miles—up 54.32 per cent over July, 1939.

See Finance page for individual companies' traffic figures.

Rudy Arnold

South African Airways has ordered a group of Lockheed Lodestars, of which this is the first, which was flown to New York for shipment. Engines are 1050 Pratt & Whitney Wasps.

AERO ITI-TRAINED MEN
Are "Readily Adaptable to Many Different Jobs"*

***The result of true vocational training for aviation pursuits—as defined in a statement issued by authority of leading Southern California aircraft manufacturers.**

Aero Industries Technical Institute chooses to give this superior type of training, both to accurately meet the industry's personnel requirements, and to serve the best interests of the students themselves.

Brief, limited *job-training* has no place whatsoever in Aero ITI courses. The student is given a broad, thorough training to make him a competent, versatile craftsman, mechanic, or engineer who can be transferred from one type of work to another when necessary, and can shoulder more and more important duties.

Training of this caliber gives Aero ITI graduates more security and greater opportunity for advancement. Hence, they make stable, progressive employees—the type of men the industry itself demands.

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JOHN K. NORTHROP, President, Northrop Aircraft, Inc.
C. A. VAN DUSEN, Vice Pres., Consolidated Aircraft Corporation

These leading Aviation industry executives supervise the policies and operation of the Aero Industries Technical Institute.

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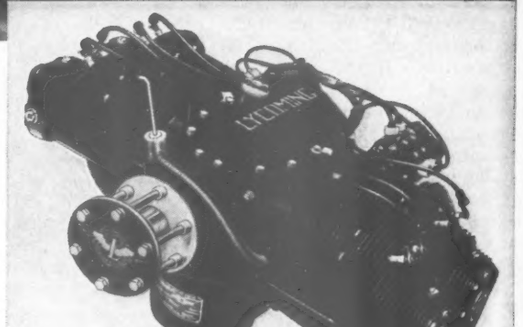
FREE LITERATURE: Illustrated folders on Lycoming light-plane engines may be obtained from all Porterfield, Aeronca, Luscombe, Piper Cub or Taylorcraft dealers. Or write Department A940, Lycoming Division, Aviation Manufacturing Corporation, Williamsport, Pa., U.S.A. . . . Cable address: Aviatcor.



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Aviation FINANCE

By Raymond Headley

Unfilled orders of the aircraft companies, now nearing the $1,500,000,000 mark, will be further increased by about $400,000,000, shortly, when national defense orders are placed for approximately 4,000 planes. In preparation for huge new U. S. and possibly British military orders, the industry is rushing construction that in most cases again will double present plant capacity. Meanwhile earnings of the majority of aircraft companies reached new high levels in the first half of 1940, and bid fair to continue upward in the current half year, excess profits taxes, notwithstanding. Air line traffic, on the other hand, is veering towards an all-time peak this fall.

Vultee Aircraft will receive additional plant space for the defense program through acquisition of the Stinson division of Aviation Mfg. Corp. in exchange for 302,168 shares of Vultee stock. This shuffle of properties controlled by Aviation Corp. will give Vultee the new Stinson Nashville plant and also permit its entry in the commercial field. Plans call for the addition of 750,000 sq. ft. of floor space to the present 180,000 sq. ft. at the Nashville plant. In its first interim financial report Vultee showed a net loss of $335,318 for the six months ended May 31. June operations resulted in a net profit of $52,000 for that month.

Adel Precision Products has received orders for hydraulic equipment from Douglas and Glenn L. Martin aggregating $55,500 and bringing the firm's backlog to $135,000. Deliveries in June were $49,200. At the annual meeting Robert D. Cavanaugh and H. S. Tenney were elected to the board of directors, according to H. Ray Ellinwood, president.

Airplane Manufacturing & Supply Corp. reports net profits for the first quarter since its organization, ending May 31, 1940, of $16,979.83. Gross sales for the period were $167,565.93. The company was formed March 11, last, when it purchased from Bendix Aviation, Ltd., two subsidiaries, Pacific Airmotive Corp., and Airplane Parts and Supplies. The new firm is engaged as wholesale and retail sales representatives of numerous aeronautical manufactured lines, and as a complete aircraft service organization with branches at Burbank, Glandale, San Francisco and Oakland.

Continuing its factory expansion program full blast, Lockheed is erecting eighteen new buildings having a floor area exceeding 520,000 sq. ft. and involving a cost of $1,500,000 for building alone, and about $500,000 for equipment, according to Robert E. Gross, president. This is in addition to the $3,500,000 Vega factory which is new being rushed to completion. With completion of this program the two companies will have a total floor area in excess of 2,100,000 sq.ft., more than doubling present Lockheed plant facilities. Combined payroll of the Lockheed and Vega plants is approximately 11,500, as of Aug. 1, with additional workers being added rapidly. *Piper Aircraft* production in June rose to 323 planes, as compared with 241 in May and was the highest monthly figure yet reached by this company . . . Howard Hughes recently acquired 30,350 additional shares of *T.W.A.* . . . *Solar Aircraft* is operating on a three-shift basis with shipments averaging more than $100,000 a month, twice that of a year ago . . . *Aircraft Accessories Corp.*, with a backlog of $750,000, reports that the month of July was the best in history for both sales and profits . . . *Republic Aircraft* reports the first half-yearly profit in its nine-year history . . . *Fairchild Aviation* had unfilled orders of $3,111,000 on June 30, 1940, as compared with $1,507,000 a year ago . . . *Sperry Corp.* paid a $1 dividend on Aug. 28. A similar payment was made in August, 1939 . . . *Hall Aluminum* is reported planning a new plant in which parts will be made for *Consolidated Aircraft* . . . *Eastern Air Lines* will open up two new routes this fall which will make it the second largest domestic air transport company from standpoint of route mileage . . . The Canadian subsidiary of *Boeing Airplane* has a $2,000,000 contract from the Canadian government . . . Air transport is expanding in part at the expense of other forms of travel as pullman traffic shows no gain this year despite the higher level of general business . . . *TWA*, which reported a loss in the first quarter and broke even in the second three months, expects more favorable financial results in the current half of 1940 . . . *Republic Aviation* has established a bonus system to permit all employees to share annually in the company's profits *Brewster Aeronautical* sales rose to $4,804,000 in the first half of 1940, as against $235,000 in the like 1939 period . . . *Glenn L. Martin Co.*, has licensed the U. S. Rubber Co. to make a bullet-proof tank.

Reflecting the record expansion in passenger traffic, domestic air mail operators in the twelve months ended April 30, 1940, increased their net revenues to an aggregate of $5,429,000 from only $14,425 in the prior twelve months. The largest profit in the period was shown by American Airlines with Eastern Air a strong second. Figures compiled by the Civil Aeronautics Board show that, of the sixteen domestic lines carrying air mail, only United Air Lines and T.W.A. operated

Current Earnings Reports

Company	Period	Net Income 1940	Net Income 1939	Common Share Earnings 1940	Common Share Earnings 1939
Aero Supply	6 mos. June 30	$281,142	$48,233	$0.66	$0.09
Air Associates	9 mos. June 30	215,735	48,943	1.90	0.49
American Airlines	6 mos. June 30	887,406	414,197	2.48	1.41
Aviation Corp.	6 mos. May 31	d 289,825	d1,000,207	....	....
Bendix	6 mos. June 30	4,295,419	2,168,210	2.05	1.03
Boeing	6 mos. June 30	69,173	d 183,550	....	....
Continental	6 mos. Apr. 30	207,739	d 126,233	0.07	....
Curtiss-Wright	6 mos. June 30	6,235,969	3,370,804	0.68	0.29
Douglas	6 mos. May 31	3,388,857	1,396,792	5.65	2.45
Eastern Air Lines	6 mos. June 30	733,925	363,416	1.32	0.65
Ex-Cell-O	6 mos. June 30	1,412,948	336,828	3.55	0.85
Fairchild Av	6 mos. June 30	318,946	141,121	0.95	0.41
G. L. Martin	6 mos. June 30	4,291,486	967,623	3.92	0.89
No. Amer. Aviation	6 mos. June 30	2,367,638	2,781,682	0.69	0.81
Penn-Central Airlines	6 mos. June 30	122,496	4,863	0.45	0.02
Republic	6 mos. June 30	842,161	.....	0.75	....
T.W.A.	6 mos. June 30	d 390,680	d 355,867	....	....
United Aircraft	6 mos. June 30	6,228,106	3,678,689	2.34	1.38
United Airlines	6 mos. June 30	577,129	216,123	0.39	0.14

d — deficit. 6 mos. June 30

With the Airlines

Company	Revenue Passenger Miles* July 1940	July 1939	% Gain	7 Months 1940	7 Months 1939	% Gain	Revenue Passengers July 1940	July 1939	% Gain	7 Months 1940	7 Months 1939	% Gain
American	29,507	19,301	52	165.063	103,136	60	....	....	....	x 363,084	213,594	69
Braniff	3,317	2,829	17	19,538	11,284	73	10,534	5,503	91	60,710	32,163	89
Chgo. & Southern	1,546	796	100	8,062	4,746	70	4,075	2,038	100	20,882	11,939	75
Eastern	11,619	7,552	54	90,958	57,604	59	28,815	20,717	52	186,874	125,948	49
Mid Continent	....	....	....	x 2,552	1,571	62	....	....	....	9,722	6,592	47
Northwest	5,920	4,344	36	27,070	16,426	64	13,000	10,940	53	67,762	41,803	62
Penn. Central	4,115	2,001	105	19,931	11,065	80	23,245	11,492	102	111,109	63,242	76
T.W.A.	15.905	9,926	60	78,409	49,457	58	....	....	....	x 131,624	78,205	68
United	25,234	16,572	52	118,527	74,912	58	....	....	....	x 185,164	112,698	64
Western Air	1,674	1,269	33	8,388	5,608	40	....	....	....	x 19,524	11,628	68

* (000 omitted)—x 6 months.

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at a loss in the period cited. In the previous twelve months eight of the carriers reported deficits.

Glenn L. Martin Co. is reported planning to spend $24,000,000 to more than double present manufacturing floor space.

Republic Aviation has plans to triple its factory space.

Bendix Aviation had the largest second quarter sales, payrolls and earnings in the company's history. New orders exceeded shipments and unfilled volume increased to approximately $45,000,000. Neither sales nor backlog as yet reflect the new national defense program.

While the investment fraternity may think aviation companies are "on the spot," they are really only in the spotlight, according to Robert E. Gross, president of Lockheed Aircraft. In an unusual open letter to brokers and investment dealers, Mr. Gross frankly expresses his optimism over the future of his industry because of its intimate tieup with the defense program, the growing demand for commercial planes and markets that thousands of newly trained fliers will create after the war. Announcing a special department to answer financial inquiries of all kinds on the Lockheed company, Mr. Gross asserts that he can furnish information both enlightening and reassuring to any who have reservations about the outlook for the aircraft manufacturers.

Consolidated Aircraft has practically completed its $2,000,000 building program and probably will deliver planes valued somewhere between $10,000,000 and $15,000,000 in the final six months of 1940, as against $408,000 in the first half. The new facilities should enable an output of close to $40,000,000 annually. Yet there is a possibility of some further plant expansion in the coming months.

United Air Lines intends to appeal the recent CAA decision fixing air mail rates over its system. While the line receives $288,000 in back pay, the new rates are expected to reduce United's present annual mail pay by around $150,000.

North American Aviation also plans to erect a sizable plant at a new location, according to President J. H. Kindelberger. Additions now under construction will increase present facilities to around 1,000,000 sq. ft. this year. The company's 6,000 employees are working in two shifts on a nine-hour-five-day-a-week basis.

Eastern Airlines was denied a certificate of C and N for the continuation of autogiro service from the Philadelphia Municipal Airport to the roof of the city post office. However, the board held that the issuance of a temporary certificate would be justified.

Penn Central announces its order for four 1941 Douglas transports, also announced its intention to file for a certificate of C and N for Cincinnati-Pittsburgh.

Northwest Airlines establishes a new business record, with 13,000 revenue passengers in July.

United Airlines will appeal CAB's mail rate decision, and seek reconsideration of the Authority's order fixing air mail rates over its system.

TWA pending the action of the CAB on its application to purchase and operate Marquette, has been given an exemption order to permit temporary operation of Marquette. The service began on Aug. 15.

American Airlines to help Chinese J. K. Li save time, told him he could pay for his ticket at any Western Union Office. Mr. Li entered telephone booth, called W.U., said, "My name is J. K. Li. Here's the price of my ticket to Boston," and started feeding coins into the slot.

Trans-Canada carried nearly four times as many passengers during the first six months of this year as in the corresponding period of 1939.

Canadian Colonial will reopen its service between the Albany and Schenectady areas and New York City; CAB approved its application to designate Schenectady as a scheduled stop. On Aug. 11 started New York-Niagara Falls service.

Mid-continent Airlines granted by CAB a new Y-shaped route between St. Paul, Des Moines and Kansas City, Mo.

Braniff Airways showed, during July, 91.18 percent increase over July 1939.

British Overseas Airways announces a reduction of fare between Sidney, New South Wales and Auckland, New Zealand.

KLM's Far East service is being continued, and is running from Palestine to Java.

Railway Express Agency advises that air express shipments for May increased 26 percent over May 1939.

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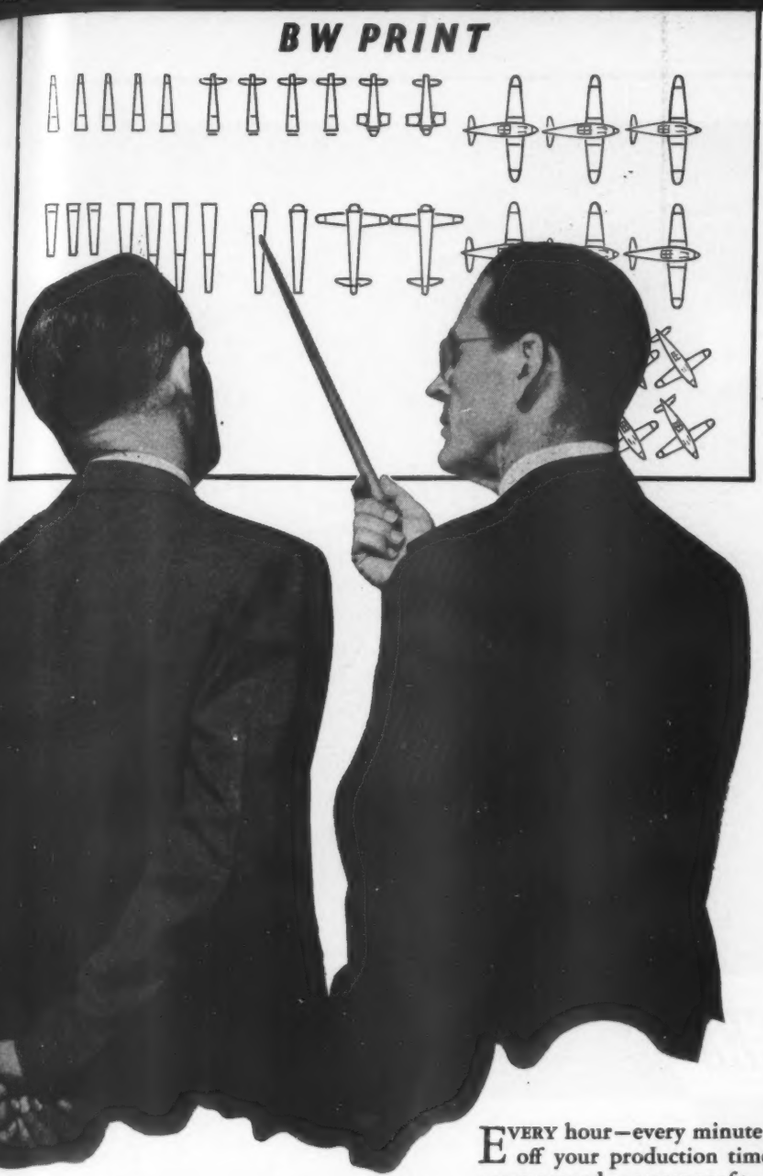

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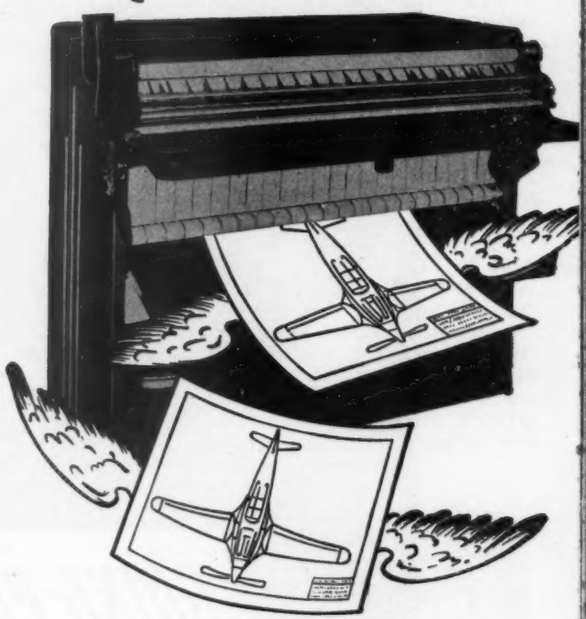

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Why are Black and White Prints faster than blue prints? Because they are exposed and developed in a matter of seconds. Because the BW Process makes possible the quantity production of prints cut to the size of your tracings through the use of BW pre-cut sheets. Because BW Prints require no time-wasting washing or drying.

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Air Mail Club

The Last Man Pioneer Air Mail Club announced last spring, will soon publish its list of members. Edward Nelson, acting secretary, of 2120 North Neva Ave., Chicago, urges all men who worked for the Air Mail Division of the Post Office between 1918 and 1927 to send in their names. The group is strictly non-commercial and will have no dues. Several hundred former air mail pilots, mechanics and other post office employees have already joined.

Carl Evers, Luscombe dealer in the New York City area, finds he is selling as many seaplanes as landplanes. In ten weeks he sold eighteen Luscombes, nine of which were equipped for water flying. A group of pilots known as the Floyd Bennett Field Spooks, who made weekend trips last summer in their Luscombe land planes, now are using seaplanes and visit shore resorts each week.

New Air Mail Pickup All American Aviation, Inc., has inaugurated service over three permanent airmail pickup routes centering out of Pittsburgh to Philadelphia; Harrisburg; Jamestown, N. Y., and Huntington, W. Va.

New Howard Plan

CHICAGO—According to officials of the Howard Aircraft Corp. of Chicago, their plans for distribution in the Eastern States are now complete.

The New England States will be covered by Inter-City Airlines, Inc., Municipal Airport, Boston. The New York City area will be handled by Seaboard Aircraft Sales, headquartering in Hangar E on Roosevelt Feld at Mineola on Long Island. The principal distributor in the Philadelphia area is Wings Field, Inc. of Ambler, Pa., and the Delaware-Maryland area comes under Air Service, Inc. at New Castle, Del.

These veteran aircraft merchants have long been leaders in the distribution of airplanes in the personal transport category, and several have been associated with products produced under the guidance of B. D. DeWeese, now director of sales of the Howard organization.

The corporation now produces the 5-place DGA-15 series of high winged monoplanes powered with Lycoming, Jacobs, Wright and Wasp engines. It will soon announce the DGA-125 Trainer for the Civil Pilot Training Program to be produced later this fall.

Sales winners in the contest which has been staged by Franklin Aircooled Motors for Aeronca and Cub dealers were announced last month. Grand prize winners in the Aeronca division were: first place, Aero Ways of Cleveland, Ohio; and second place, Beebe Air Service of Hastings, Neb. Eli A. Ellison received the award in behalf of Aero Ways and won the $250 salesman's prize. Ray Beebe received $150 for his company, with Frank L. Cushing receiving a like amount as leading salesman.

In the Piper Cub division first prize went to Des Moines Flying Service, Des Moines, Iowa, represented by Howard Gregory and R. W. Cook. Second place went to Lou Foote Flying Service of Grand Prairie, Texas; and third honors going to Ong Aircraft Corp., Kansas City, Mo. In addition to these prizes, leather wallets and $50 in cash were presented to about a dozen men.

Speaking of insurance, the Continental Casualty Co., through its general agents, Parker & Co. of Philadelphia, has announced its new rates for pilot policies, the lowest in history, they claim. For $20 a year you get a policy that pays $3,000 death benefit for aviation accidents, up to $500 for doctor and hospital bills, medical reimbursement up to $500, and coverage for all types of aviation accidents including bailing out. Student pilot rate is six months for $10.

You'll probably soon see Associated Aviation Underwriters' new Stinson 105, as field manager William W. Walter is flying it about the country. This firm represents the aviation departments of 36 insurance companies, and the ship is expected to fly some 50,000 miles a year.

The Joe Jacobson Flying Service, which has been located at the Municipal Airport for more than ten years, is very busy these days with CAA students. With the re-rating of several of his instructors, Jacobson has been able to take on a lion's share of the Kansas City CAA business. He now has 30 primary students on the Kansas side of the river, 25 in Missouri, refresher students at Lawrence, Kansas and advanced refresher students at his own field.

Instructors are Joe Jacobson, Paul Howe, Bob Cummings, Ed Wathan and Eulesse Epps.

Stinson Flying Corp., originally formed to act as Stinson distributor in Southern California, has been appointed Stinson distributor for Northern California as well, and has opened headquarters for the San Francisco Bay area in the Administration Building, San Francisco Municipal Airport. The southern office continues at Grand Central Air Terminal. The Northern California appointment came as a result of the sales record in Southern California, where the entire year's quota of planes was sold in the first four months of operations. Al Lary, widely known on the Pacific Coast, is in charge of sales for both branches of the Stinson Flying Corp. Lu Cook is in charge of Southern California sales work and Harold Brown is manager for the Northern California district. Jim Neely has been added to the organization to foster flying club activities. Dealers named in Northern California include the Stinson Flying Co., division of Duck Air Services, of ASA Airways, and the Duck organization in Red Bluff and Redding. Southern California dealers are established at Union Air Terminal, Los Angeles Metropolitan Airport, Clover Field, Los Angeles Municipal Airport, Tri-City Airport at San Bernardino, and Imperial.

LEE HIPSON, left, instructor at the Harvard Aviation Camp, checks a map with student Charles Cole. This was one of the many colleges that carried on C.A.B. flight instruction throughout the summer.

Harris-Ewing

THE BOYS AT THE HARVARD AVIATION CAMP were all out flying when this was taken. Twenty-nine students carried on flight training under C.A.B. at this camp at Falmouth, Mass., airport. Dr. William Bollay was in charge of the ground school.

Airport development is being rushed in the Los Angeles area as expansion of manufacturing and pilot training programs, both civil and military, begins to crowd available space. Clover Field has been turned over to Douglas Aircraft Co., completely eliminating private flying based at this port, and it is understood that Douglas plans to extend the present factory into the space made available by cessation of private operations.

TRAINING

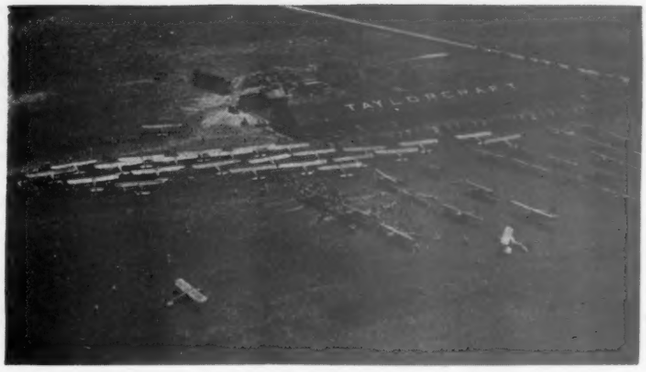
Casey Jones is opening an addition to his Newark School this month at La Guardia Field. Known as the Academy of Aeronautics, the school will offer two courses: one in aeronautical design and construction which will take 2½ years to complete; and an aircraft mechanics and construction course running for two years. A brand new building is being equipped with much new machinery and instruction equipment.

Demonstrating the speed with which the commercial aircraft schools can expand to meet the industry's need for trained factory workers, the Fletcher Aircraft Schools are training approximately 1,000 men on a schedule of three shifts per day in their three branch schools in the Los Angeles area. According to Maurice C. Fletcher, business manager, additional trainees are being enrolled at the rate of 250 per week. Nearly 4,000 men have already entered the aircraft industry through the Fletcher training plan, which includes a factory-approved selection test to grade the prospect by personality and aptitude.

The Faust Aircraft Sheetmetal School of Jericho, N. Y., is completing a handsome new building this month. Organized last fall, the school has found such a demand for its students that it has had to build a new structure. The school now has about 200 students.

Roosevelt Field, Long Island, became so congested that Safair was forced to take its 60 CAB students to nearby fields. Every morning Safair instructors fly the Cubs to adjoining fields where students fly all day. At night time ships are ferried back to Roosevelt.

Threatening to disrupt the CAA pilot training work being conducted by The Western Air College, Alhambra, Calif., a row is now raging over attempts by the Alhambra High School authorities to close the Alhambra Airport. TWA, owner of the airport, is remaining strictly neutral while school authorities, city officials of Alhambra, and Kenneth Hawkins, president of Western Air College, seek to reach an understanding which will make it possible to continue flight instruction for 170 embryo pilots. The Western Air College is one of four CAA training centers in Los Angeles County. High school officials have contended that airport operations disturb students at the school, disrupt classes, and constitute a hazard. The school, only recently erected adjoining the airport property, is seeking abatement proceedings against the airport operation.



SCENE AT THE TAYLORCRAFT FIELD when the All-Ohio Air Tour made a visit there. Some 44 ships were in the Tour, and this picture shows an additional twenty planes just turned out by Taylorcraft ready for delivery.

Luscombe School of Aeronautics has opened a new sheet metal shop in the plant of the old Ajax Rubber Co. of Trenton, N. J. Considerable new equipment was purchased for the 10,000 sq.ft. of floor space. Two new courses will be offered this fall: an eight months' course in engines, and an eight months' course in airplanes.

City of Buffalo is holding a civil service examination on Oct. 7, for position as air traffic control tower operator. Two appointments are open at salaries of $2,200 per year. For details write to the Municipal Civil Service Commission, Buffalo.

Celebrating the third anniversary of its founding in September, 1937, Aero Industries Technical Institute, Los Angeles, has completed the seventh building on its campus and started construction on an eighth. When Aero ITI opened its doors in 1937 there were only three buildings on the grounds. Rapidly mounting enrollments have required an almost continuous building expansion program. The building just completed, a two-story brick and steel structure with 12,000 sq.ft. of floor space, is the second complete building provided for the exclusive use of the engineering department. In addition to natural lighting provided by windows and skylights the entire building is equipped with fluorescent lighting. Since May of this year engineering student enrollments have increased more than 100 percent.

The eighth building, now under construction, will be of the same modern design as other Aero ITI structures, will provide 8,000 sq.ft. of floor space, and will be used for an expanded aircraft engine department.

Formal opening of the Cal-Aero Flying Academy, Ontario, Calif., will be held Sept. 14, according to announcement of Maj. C. C. Moseley, president of the $250,000 institution. This is one of the branch schools set up to handle the Army Air Corps expanded pilot training program. Headquarters for the Cal-Aero school continues at Grand Central Air Terminal, Glendale, and another branch school is already in operation at Oxnard.

The Sweeney Aviation Schools, Inc., Fairfax airport, Kansas City, are operating on full schedules under the government expansion program of student training. Receiving CAA approval on May 1, this school is now giving government approved courses for A & E licenses and short courses in aircraft welding and sheet metal fabrication. Under present facilities, Sweeney will graduate 250 airplane and engine mechanics, 1,000 sheet metal workers and 300 aircraft welders annually. A special, short-term engine mechanics course also is offered for those who are not in a position to enter upon the government approved course.

Missouri Aviation Institute of Kansas City, Mo., will shortly increase its student output to 100 graduates weekly and a new business association of the Bredouw Aeromotive Corp., will lead to the development of a semi-plastic trainer plane in Kansas City. Don Frye, personnel manager of the Consolidated Aircraft Corp., has been named as assistant to Homer L. Bredouw.

Norman, Okla. To meet an urgent need for aircraft welders the University of Oklahoma has created almost overnight a welding school capable of turning out more than 500 trained workers each year.

Although the first class of 75 students was enrolled only last July 22, the school has already supplied more than 40 skilled welders for aircraft factories in the mid-west. Most of those already employed have been hired by the Waco Aircraft Co., at Troy, Ohio, and a few have accepted jobs with the Stearman Aircraft Co., Wichita, Kan.

Other plane manufacturers are seeking additional welders in telegraphed pleas to instructors in the school, but some of the students first enrolled are not ready to pass the severe government test which is the final examination of the course. A waiting list of 400 persons will be combed to select men to receive the training in the future.

So anxious were aircraft plants to get expert welders that several have donated equipment and have sent special instructors to aid the university technicians conducting the school.

Inauguration of a two-fold engineering training program was announced by Hall L. Hibbard, chief engineer of Lockheed Aircraft Corp., on July 31. To obtain additional engineering talent 120 graduate engineers, between the ages of 30 and 40, were started through an eight weeks' course at California Institute of Technology, to convert them into aircraft engineers. The men are from various engineering professions, not engaged in essential national defense work. Each man is paid a monthly salary by Lockheed while in training, plus travel expenses to Los Angeles, and is guaranteed a job on completion of the course. Instruction at Cal Tech is given by Dr. Clark Millikan, Dr. William Sears, Dr. Louis G. Dunn, Dr. Ernest Sechler, Dr. A. L. Klein, and Howell N. Tyson. The curriculum includes: Description of airplane, 15 hours; aerodynamics, 40 hours; structures and stress analysis, 40 hours; materials and standards, 25 hours, and aeronautical drafting 120 hours. Upon completion of the work at Cal Tech the engineers will receive an additional eight weeks of training at the Lockheed plant before being put to work in the engineering department.

Cub production in June set new records. Piper turned out 323 units and Taylorcraft 82 (102 in July).

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First Around the World — First in Air Defense
DOUGLAS

Airline Progress

(*Continued from page 29*)

Flying was different then. There was no space for passengers, and the pilot rode in an open cockpit instead of a steam-heated cabin. We hear a lot of the war time Jennies that started many of today's famous pilots on their barnstorming careers. But it was the American-built DeHavilland that carried the bulk of the early air mail. The Army had a vast surplus of these machines at the end of the war, and they were passed on to the Post Office Department for mail planes.

Planes that were satisfactory to the Army were not satisfactory to the air mail pilots. The DH's were put through such a series of changes that the original designer would not have recognized some of the modified models. Landing gear was moved forward, gas tanks were shifted about and the front cockpit was altered to hold the mail. Several kinds of wings were used. A stronger veneer was put in the fuselage.

"Every pilot in those days had his own airplane," said R. E. Pfennig, Eastern Division operations mgr., in a reminiscent mood recently. "At Maywood Field, Chicago, where we rebuilt the DH's, we had to modify each plane to suit the pilot. We built the seat to fit him. Each man had his own ideas about the slope of the windshield. And they wanted their planes rigged to suit them, too. But they had a tough time flying in those days, and we gave them what they wanted."

Engines were different, too. The DH was powered with a 400 hp. Liberty engine. Spark plugs were changed after every trip.

"We changed plugs by the barrel fulls," said a United foreman who had been a mechanic at Maywood. "They were Army surplus material and we just threw them away after they were used. Distributor heads were also changed after each trip. Our chief annoyance, though, was with the water jackets. We had constant trouble with them—and so did the pilots. In fact, the pilots tried to arrange their forced landings so that they would be near a welding shop. The pilots got to know where all the welding shops were along their routes.

"When we first began servicing mail planes," he continued, "we gave the Liberties a complete overhaul every 50 hours. Then we got the overhaul period up to 100 hours where it stayed most of the time. Occasionally a pilot got hold of an engine that he liked and that he didn't want to give up after 100 hours, but most of the engines sure needed an overhaul after 100 hours. Today there is 600 hours between overhauls."

At United's main overhaul base in Cheyenne a group of maintenance men were looking over early pictures and discussing the old days.

"We used to get up at three in the morning in the winter," said one. "We had to, if the pilots were to leave on time. The hangars were practically open barns and were cold as an ice house. The only way we could get the Liberties started was to boil water on the small hangar stove. We had to heat the oil, too. Then we'd pour in the water and oil, and several of us would form a chain by holding hands—and we'd pull the propeller through. We had to work fast or the water would freeze. Half the time we couldn't get the engine started and we'd have to drain out the water and oil and start over again."

But pilots had the real problems. There was little or no reliable weather information. There were no two-way radio or radio beams. Compasses were not dependable. An airplane could fly only 300 or 400 miles between re-fuelings. Pilots had to fly under the weather, and on westbound trips they stayed pretty much on the tree tops. On eastbound trips they seldom climbed over 3,000 ft.

Listen to Postmaster Bill Haas of Cheyenne, who has been in charge of that branch of the government work there since the earliest air mail days, "Those pilots were top-notchers. How they got through some of the storms we folks on the ground never knew. One winter day I was out at the field and it was snowing so hard we couldn't see 100 ft. It was Jack Knight's schedule, going east. I said, 'Jack, you're not going out in this storm?' And he said, 'Sure I'm going out.' He climbed into his heavy, fur-lined flying suit, the boys warmed up his ship and off he went. He disappeared in the snow before he got off the ground. We heard his engine overhead for a few minutes. Then he was gone. I felt pretty bad about it, because I was sort of responsible for the boys. But later on we got a telegram from North Platte saying he'd arrived o.k.

"The pilots used to fly by watching the semaphore signals of the U. P. railroad. When the weather was bad they used to fly right along above the rails and I guess a lot of them just barely clipped the tall grain elevators along the tracks. They had so many forced landings away out in the country that the U.P. gave them all switch house keys. They could walk along the tracks until they came to a switchhouse and they could wait inside until a train came along. The U.P. gave orders for all of its trains to stop to pick them up.

"Once Frank Yager had a forced landing near Medicine Bow, out here west of Laramie. He wired us he needed a whole new engine. So our mechanics loaded a fresh Liberty on the Overland Limited—the crack train on the line—and the division manager ordered the train to make a special stop at Medicine Bow and even got a section crew out of bed at 2 a.m. to unload it. So Frank got going again that same day. But a lot of the boys weren't that lucky. Forced landings in these mountains was a tough business."

When the airmail schedule first went through from coast to coast the mail was flown only in the daytime. At night it was put on trains, carried until the next morning, and shifted to planes again. Although flying across the Alleghanies and the Rockies day after day, and keeping schedules along the entire route was an heroic undertaking, and the outstanding flying of its kind then being done anywhere in the world, it did not get a great deal of attention from Congress or the public. The Post Office Department, as well as the pilots, realized that before any real appropriations would be made by Congress the mail would have to be flown by night and day continuously from New York to San Francisco.

So plans were made for what was later to be called the great night flight—or perhaps the great Knight flight is a more appropriate title. Early on Feb. 22, 1921, mail was loaded into a ship at San Francisco and flown eastward to Reno, then to Salt Lake, Cheyenne and on to North Platte, Neb. There it was picked up by Jack Knight who was to fly it to Omaha. But when he reached Omaha, there was no pilot to carry it on to Chicago. Jack had already flown two trips that day and he was tired from pushing his plane about in the air. It was already dark, and he was not familiar with the route to Chicago. He had been in a crack-up a few days earlier and his nose was broken, which added greatly to the discomfort of flying through the cold February weather. Another pilot might have said, "Enough is enough!" and the demonstration flight on which all air mail employees were counting might have ended right there. But Knight ordered his ship refueled and off he flew into the winter's darkness.

The Post Office had wired ahead and requested that bonfires be lit at airports and other critical spots along the route. But snow began to fall, and bonfires give only a feeble light at best. He picked his way along the route, relying more on his own experience than on his erratic compass or the sketchy map at which he peered occasionally. Over Iowa City the flight almost ended in catastrophe. Out of gas, not sure

250,000 *Cyclone* HORSEPOWER for the FLAGSHIP FLEET

Already operating the largest commercial fleet of aircraft in the world, American Airlines is now taking delivery of additional Douglas airliners which give its exclusively Wright Cyclone-powered fleet a total of over a quarter-million horsepower. Every hour of the day and night, at least 22 Cyclone-powered Douglas Flagships are in the air flying American's 73,000 miles of scheduled daily routes.

American has logged with safety over 700,000,000 passenger-miles in the last 4 years alone behind Wright Cyclones, and will this year carry nearly a million passengers, considered a remarkable showing for the entire industry a few years ago. These figures are impressive evidence of the part played by Wright Aircraft Engines in the advancement of air commerce.

IT PAYS TO FLY

WRIGHT AERONAUTICAL CORPORATION

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WRIGHT *Aircraft* ENGINES

where he was, or where the field was situated, he considered a forced landing. Suddenly out of the darkness below a feeble light flickered. Jack circled close and made out an air field. The flare had been set by the field's night watchman, who helped Jack gas up and continue on his way. Hour after hour he pushed on, keeping himself awake by pinching himself and slapping his face. At dawn he reached Chicago where the mail was turned over to a fresh pilot and carried on in several stages to New York. The mail reached the East Coast 33 hours and 21 minutes after it had left San Francisco. This was a new high in airmail speed, as the best previous time had been 79 hours and 44 minutes.

This flight was not just a stunt. It brought immediate results in that Congress appropriated money for lighted airways, although it was 1924 before regular day and night schedules were flown across the country.

By 1926 the Post Office Department concluded that the time had come to turn the air mail business over to private contractors. Varney Air Lines was the first private company to carry the mail. Pacific Air Transport began flying from Seattle to Los Angeles in 1926. In 1927 Boeing Air Transport secured the route from San Francisco to Chicago, and that year National Air Transport began flying the mail from Chicago to New York. Later all four of these companies were combined to form United Air Lines.

Gradually other planes besides the De Havillands came into use. By 1928 National Air Transport was using a dozen kinds of airplanes, including DH's, Mercurys, two types of Curtiss Carrier Pigeons, Travelairs, Douglas mail planes, Ford Tri-motors, Stinsons, Pitcairns, Northrops, Falcons, and two kinds of Boeings.

Passengers began to be carried when the Boeing 40's were introduced in 1927. It cost $400 and took about 32 hours to cross the country, and refueling stops were made at some fourteen places. Passenger comfort was given little consideration. In 1929 Boeing Air Transport put its large Boeing 80's into service. These were tri-motored ships that could carry twelve passengers which later were enlarged to carry fourteen. The following year NAT put Fords in service, and multi-motored equipment was available from coast to coast. In 1931 United Air Lines was formed and gradually the names of the four predecessor companies dropped out of use.

The year 1933 marked a milestone in air transportation when United put the revolutionary Boeing 247's into service. They immediately outmoded all passenger airplanes then in service. Equipped with two 550 hp. Wasp engines, the Boeing carried ten passengers and a crew of three at speeds up to nearly 3 miles a min. By 1937 passenger traffic over the Main Line had grown to such proportions that United needed larger airplanes. Douglas DC-3's were added to the 247's in service. Sleepers as well as more luxurious day planes were offered to the public. The next step will be the four-engined Douglas DC-4's next year.

Every phase of air travel has made progress since the old days. The longer cruising ranges of today's ships bring added safety. If one airport is closed down, the pilot has ample gasoline to fly elsewhere. With even as recent a ship as the Boeing 247, the pilot had enough range to fly only from Chicago to Des Moines. Today he can fly from Chicago to Salt Lake and land with plenty of gas in his tanks. The story of United's engineers who developed two-way radio is told elsewhere. The safety features of radio are appreciated only by those who flew in the old passenger ships, in which a pilot was forced to fly close to the ground so he could see familiar landmarks. Today a pilot soars far above unpleasant weather. Pilots now have an improved flight technique. Formerly one pilot flew high, another low; one made sharp turns, another easy turns. Now all fly alike in the one way that has been found to be best.

The passenger stations today are a far cry from the cold, bleak hangar offices where passengers used to wait for planes. Limousine service is improving each year. Tariff liberalizations now permit optional routings and layovers, as well as all-expense tours. Air script cards, now held by 140,000 persons, have brought reduced fares for persons and firms doing much air travel.

Food service is one of the great strides forward. In the old days a passenger had to bring his own sandwiches. Today he is served a hot, five-course meal at no additional cost over the price of his ticket. Stewardess service, introduced first in this country by Boeing Air Transport in 1930, brought new comforts to passengers.

Air travel is moving so fast that even conservative prophecies are out of date in a short time. With supercharged, high-flying DC-4's soon coming into the picture, travel by air will be faster and more comfortable. Fares in the future will undoubtedly be lower. There will be more routes with two rates, such as United now has from San Francisco to Los Angeles, with less being charged for the slower service.

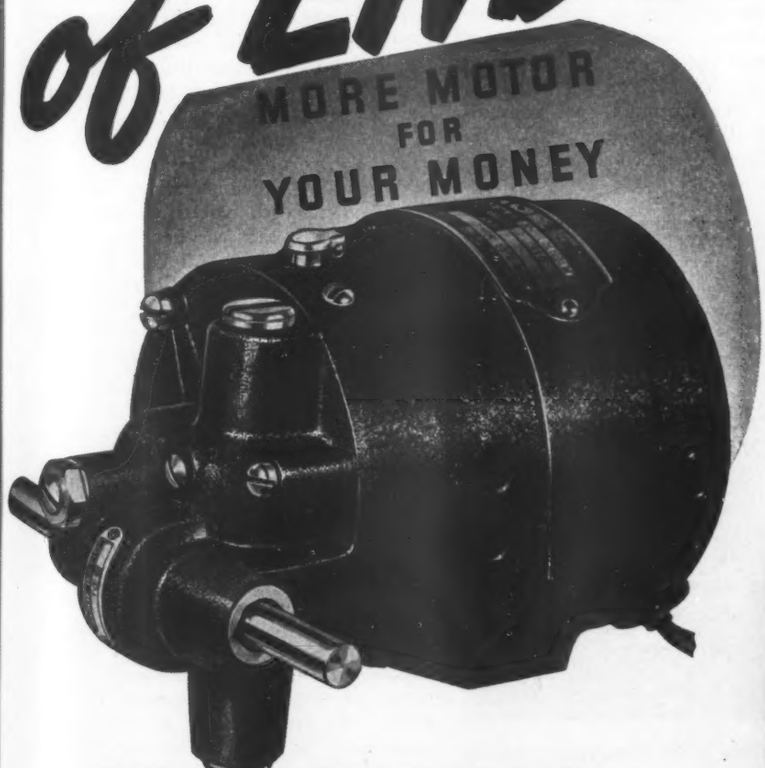
There will be more belt airlines, connecting groups of airports in a large metropolitan area with the main terminal. In the New York area, for example, there are half a dozen fields within 50 miles of La Guardia which could be tied together by a belt line. There will also be more limousine services from towns without airports to towns where airlines stop. At present there are only 250 cities on the airlines. In the future many others will have feeder line service. Cargo ships will be used on the main lines and ships running on the less-used routes will carry much more air express than is the case today. Charter service is very much in its infancy today. United alone had more charter service in the first four months of this year than in all of 1939.

Air travel is the logical, modern way to travel. Each month airline business is from 50 to 70 percent better than in the same month of the preceeding year. The problem of the airlines today is not so much how to get new business as to accommodate what they have. Air travel has gone through the trying Twenties, the troublesome Thirties and has now reached the flying Forties. From the beginning of transcontinental air routes in 1920, no other form of travel has ever made so much progress in twenty brief years.

Seven DeHavilland mail planes lined up at Omaha in 1921.

Speaking of ENDURANCE

Wes Carroll and Clyde Schlieper, young Long Beach, Calif., fliers, broke all existing endurance records October 27, 1939.



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Series (Universal), 0-60 cycles; H. P. range, 1/478 to 1/82; full-load speed range, 7.4 to 111 r. p. m.; amperes (115 v.), .39; watts input, 43; duty, 30 min.; bearings, self aligning composition bronze; finish, black crinkle enamel; weight, 3 lbs. 7 oz.

Continuous flight for 726 hours is a staggering strain on man and machine. Yes, it took extra endurance, plenty of it, to stay aloft in their tiny craft, 73 hours beyond the big plane record. That's the kind of stuff Dumore fractional horsepower electric motors are made of. Engineered to carry on hours and hours beyond what is considered normal for motors of their type, Dumores are selected for better electric appliances, precision business machines, and delicate controls on aircraft, medical devices, astronomical equipment and the like. No matter how demanding or unorthodox the power problem—Dumore engineering service has a reputation for finding a happy solution. Read how the aviation industry depends on Dumore . . . write for the new brochure, "Speaking of Endurance."

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Dumore Motors

FOR EXTRA POWER HOURS

Airline Research

(*Continued from page 31*)

1934 to the Chicago Airport. The men making up the staff of the laboratory are either experienced men in the field of radio communication or men taken directly from colleges where they have studied electrical engineering.

The laboratory has three objectives. First of all, it takes over work of commercial manufacturers. This takes the form of developing special radio equipment when the manufacturer either lacks the necessary research facilities or does not feel the idea warrants large expenditures in research. Second, the laboratory tries to place itself in a position to deal with manufacturers and to advise the airline's purchasing personnel in acquiring new equipment. The third aim of the department is to assist in solving operation problems. There is no better place to investigate these problems than in the communications laboratory. The engineers, through their long experience in research, have a full knowledge of the problems that present themselves in radio communications and are constantly working toward what might be called an ideal system.

The facilities of the lab at present occupy about 15,000 sq.ft. in the United hangars at Chicago Airport. One section of the lab contains all the testing equipment as well as a workshop for building newly designed equipment. There is also a model shop for the construction of new designs previous to testing, and a metal-working shop.

Ideas for problems to be worked out come to the lab from numerous sources. Men working out on the line contribute a great deal when they find "bugs" in either the communication system or in the equipment. These problems are sent either to Cunningham or Sandretto for immediate consideration. Together with these are the ideas that come from the communications laboratory personnel. The problems that require further research are then scheduled into a program by Pete Sandretto. His first step is to make a preliminary report, including all of his own ideas on the subject, plus reference to previous work that has been done in the lab or in other research labs. When the report has been turned over to one of the staff for study an entry is made upon a board so that an accurate check can be kept on the progress at all times. The engineer to whom the work has been assigned is then left entirely on his own to complete the project. Research and design are done by him and the model is constructed and tested. The laboratory test program (a very thorough one) requires that first the equipment work efficiently under normal conditions. It then makes the rounds on the vibration table, high altitude chamber (if altitude is apt to affect the operation) the cold chamber, and finally the drop test. After this it is run in service operation. An engineer usually accompanies the equipment on what is called a service test. When the equipment has successfully completed the program, and the company has decided to adopt it, specifications and recommendations are then sent to the purchasing department.

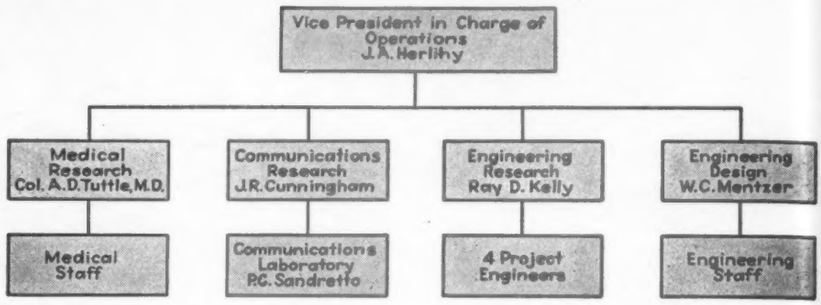
Of course, all during the complete research test and service test program, reports are turned over to Sandretto at regular intervals, who keeps in constant touch with all of the work in the lab. Once each month he makes up a progress report showing the exact status of each project and turns this over to the officials of the company.

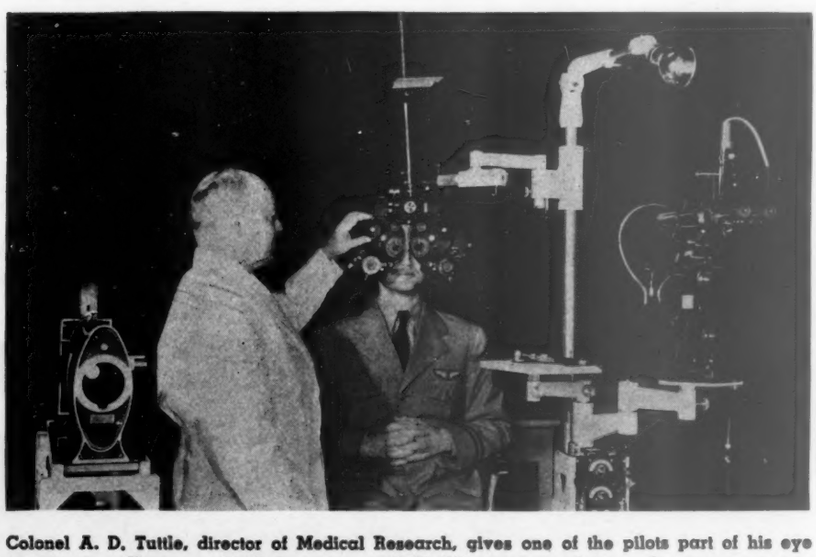
One of the foremost developments of this department was the two-way radio communication. No comment need be given explaining how important this has been to successful airline operation. A few years ago, after a lengthy period of research, United developed the static discharge cartridge—one of the major contributions to clarifying ground communication. As a result, static encountered during certain types of bad weather has been practically eliminated. All United ships carry two of these devices. Incidentally, the bill for the research work on this was $30,000.

In another line of radio communication the laboratory has done a great deal on instrument landing. As a result of the work transmitters were located at several airports throughout the country with standard receivers installed on United planes. Although at present the government has adopted another system of instrument landing, there is no doubt but what United's work has certainly been a great contribution to this type of navigation.

Economies in operation as a result of research work is oftentimes enormous for but a single piece of equipment. As an example, a redesigned transmitter previously had cost $3,000 per unit. Power upkeep on the new one was cut 60 percent and the price

Organization of Research





Colonel A. D. Tuttle, director of Medical Research, gives one of the pilots part of his eye examination. There are 23 distinct steps and 63 different tests given to the eyes to assure optic efficiency.

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FOR SYNTHETIC RUBBER

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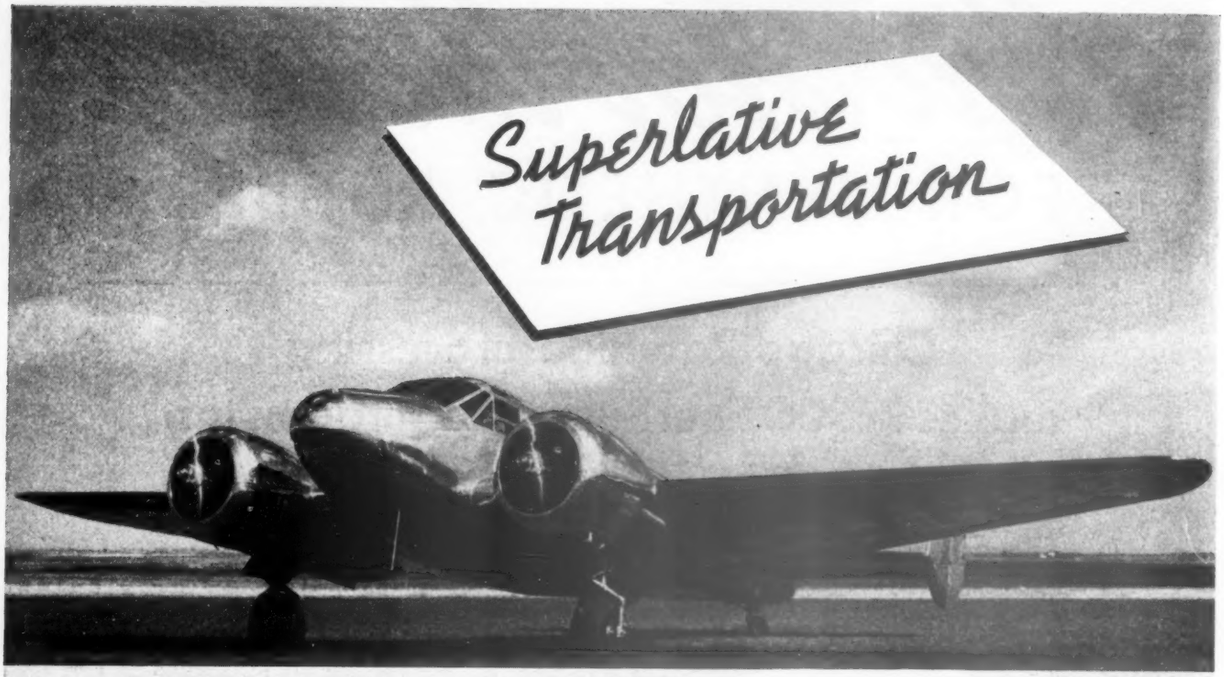

THE MODEL 18 all-metal BEECHCRAFT powered with two 450 H.P. engines has been selected in various versions by the United States Government and foreign Governments. Among the uses to which these high-performance airplanes will be devoted are Mapping Photography, Personnel Transport, Ambulance Service, Observation, and Military Training.

The selection of the Model 18 BEECHCRAFT for these different uses was determined by one or more of the following abilities that it possesses:

1. It can fly high. (It cruises easily at 25,000 feet altitude.)
2. It is fast. (It cruises at 220 m.p.h. on 62½% power.)
3. It has low speed stability. (Power-on stall occurs at less than 55 m.p.h.)
4. It can utilize small fields. (Take-off run is 500-600 feet.)
5. It has excellent payload with long cruising range.
6. It is adaptable to skiis and seaplane floats.

The combination of these abilities in one airplane is unusual. They add up to make the Model 18 BEECHCRAFT a superlative vehicle of personal transportation.

Several are under construction and are available for early fall delivery. After these are purchased, future deliveries will be subject to U.S. Government priorities and considerable delivery delays probably will be unavoidable.

Responsible inquiries are invited.

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Shielded Type, Single Row Ball Bearing

Single Felt Seal Shielded Ball Bearing

Kollsman Instrument Division of Square D Company (Elmhurst, N. Y.) says, "KOLLSMAN FOR PRECISION is not just a phrase. It is both the ideal and the achievement of KOLLSMAN INSTRUMENTS * * * * * In performance, KOLLSMAN PRECISION INSTRUMENTS function to unsurpassed standards of accuracy."

As measuring up to their own standards of precision, quality and performance, it is natural that Kollsman engineers should turn to NORMA-HOFFMANN PRECISION BEARINGS for the Kollsman Centrifugal Tachometer, for the Magnetic Tachometer, and for the generator of the Electric Tachometer.

American instrument makers—both those supplying the aviation industry, and those serving the industrial and scientific fields—have been using NORMA-HOFFMANN PRECISION BEARINGS for years. They recognize that NORMA-HOFFMANN PRECISION stands for those characteristics which commend them for the exacting duties of precision instruments.

Similarly, builders of aircraft and of aircraft accessories and equipment, avail themselves of the dependability and friction-free performance of NORMA-HOFFMANN PRECISION BEARINGS—"where the bearings must not fail." For NORMA-HOFFMANNS have been PRECISION BEARINGS from the earliest days of the bearing industry; and many of today's standard aircraft bearings were developed and pioneered by NORMA-HOFFMANN.

Write for the Catalog. Let our engineers work with you.

"NORMA-HOFFMANN"
PRECISION BALL BEARINGS

NORMA-HOFFMANN BEARINGS CORP'N., STAMFORD, CONN. U.S.A.

brought down $400, as well as resulting in a more efficient transmitter. The money saved in this unit alone for that year amounted to almost $100,000.

Engineering Research

Ray Kelly, in charge of the engineering research department, has four project engineers under him who handle passenger comfort, power plant, accessories and theoretical design. Each one of these project engineers in turn takes over all problems that in general deal with his department and frequently two of them work together when a project is of mutual interest.

Problems come to the department in much the same manner as they do to the communications section. Here again a preliminary report is made out. Next, the project engineer is assigned, whose job it is to start investigating all the previous work that has been done. When he has decided upon the design of the new equipment, the work is turned over to the engineering department to draw up the plans. Manufacturers are then contacted and to them go the specifications to build the equipment. Then comes the program of testing. If a part is to eventually be installed on one of the planes, it is first given flight tests either in the flying laboratory or on one of the transports designated for that purpose. After this flight test has been successfully completed, the equipment is installed on one of the regular transports and an engineer assigned to accompany the ship for a period of time, making further examinations as to operation.

All of the data collected during these flights is entered on various forms so that an accurate record is kept at all times. These flight reports are then sent back to headquarters at Chicago where they are kept on file with all of the other material on the project. In addition to these, every week a service test record is made from the shop to which the equipment has been assigned. All irregularities are reported as well as recommendations which are of great help in working out the bugs in the new equipment.

The radio laboratory has designed a control panel for the DC-3's which selects any type broadcast.

The reason for this research is not that it is felt the equipment will not work satisfactorily, or that it is inefficient, but that the engineers believe no matter what has been developed, it can still be improved upon. There is no better place for finding just what these improvements can be than in observation during actual flying conditions. Thus a service test is given to all parts of the plane, which yields results that are of enormous value in further purchasing of equipment for the company and even in the designing of new ships for the line.

The name of the passenger comfort department is self-explanatory. Research along these lines is one of the most extensive carried out by the company and results bring returns in dollars and cents. After all, there are only a few passengers interested in the details or the operation of the airplane, most of them wanting to get from here to there as quickly and as comfortably as possible. But what they do notice is the food, heat, ventilation, soundproofing, etc., and these are but a few of the problems tackled by the passenger comfort engineers. The results speak for themselves.

To the power plant section are turned over all problems dealing with the operation of the engine and propeller. New types are always under investigation and the marvelous safety record that the airliners have racked up for the past seventeen months shows some of the accomplishments of this department. Work on de-icers, landing gears, instruments, etc., falls under the responsibility of the accessory department. Here again is a field largely responsible for the safe operation of the airliners.

Medical Research

The most important physical variables affecting people while in flight are vibration, noise, ventilation, temperature and altitude. With this in mind the medical research department works with but one proposition in view —"anyone that is able to walk is able to fly." Under the able direction of Colonel Tuttle, a never-ending program of investigation and research is in progress to fulfill their firm belief in safe and comfortable air travel.

Started in 1938 when United Air Lines completed the installation of the medical center in its Chicago headquarters buildings, the department has grown in its scope of activity until now everyone, whether he be a mechanic or charterer of an airliner, is under the constant eagle eye of the medical staff. To be more explicit, they carry out the dual responsibilities of providing the best possible health service for flight as well as ground personnel and undertake the investigation of passenger comfort aloft.

Each person employed by United must cooperate with the medical department to make certain that he is in a constant state of good health. A preemployment examination confirms the fact that employees are healthy at the

The high altitude test chamber is used by all of the research departments. It is the only one of its kind owned by an airline. Here a radio directional antenna is about to be tested.

The "Operations" class of '40. Practical knowledge is gained through actual operation of a scheduled airline.

At the ticket desk, reservations, cancellations and other problems are handled by a student ticket agent.

Students in the airline office handle mail, cargo and passengers, while at the pilot desk the "flight plan" is plotted.

Studying weather reports, the student meteorologists draw weather maps, make predictions prior to each scheduled flight.

With two-way radio, the co-pilot in the plane keeps in contact with the ground station during the trips.

The class watches checking of express and mail while line mechanics make final inspections prior to a scheduled flight.

You Need the PLUS VALUES in PARKS Leadership Training

To Fit Yourself for Success in Commercial Aviation

As one of many young men today who are thinking about and planning for a career in commercial aviation, you realize that your success will require much more than flying and mechanical skill. Flight and mechanics are taught at Parks, to be sure, but these skills, by themselves, are not enough. You require much more if you are to make valuable contributions to the industry of air transport, help it to develop and continue as a *profitable business.*

The high standards maintained at Parks, the thoroughness of its complete educational plan, are designed to develop your capability to do original and constructive thinking, to equip you to contribute to the profitable and successful progress of aviation as an industry.

Parks works closely with the aviation industry and Parks can and does qualify you to meet their strictest requirements. At Parks your education will go far beyond mere knowledge of flight and mechanics; you will acquire a sound and well balanced background; increase your ability to think for yourself and acquire practical knowledge of the problems you must meet and *solve* in order to advance to leadership.

To prepare yourself for leadership in aviation you should first know all the facts about the training program of Parks Air College. Parks offers you a college education, specialized and practical, in each of the four major branches of commercial aviation — its four courses are: Professional Flight and Executive, Aviation Operations and Executive, Maintenance Engineering and Aeronautical Engineering. Mail the coupon today for complete information. The catalog will be sent you free of charge or obligation.

Section AV-9

PARKS AIR COLLEGE
East St. Louis, Illinois.

Please send me details of four major courses in commercial aviation training.

Name.....Age.....

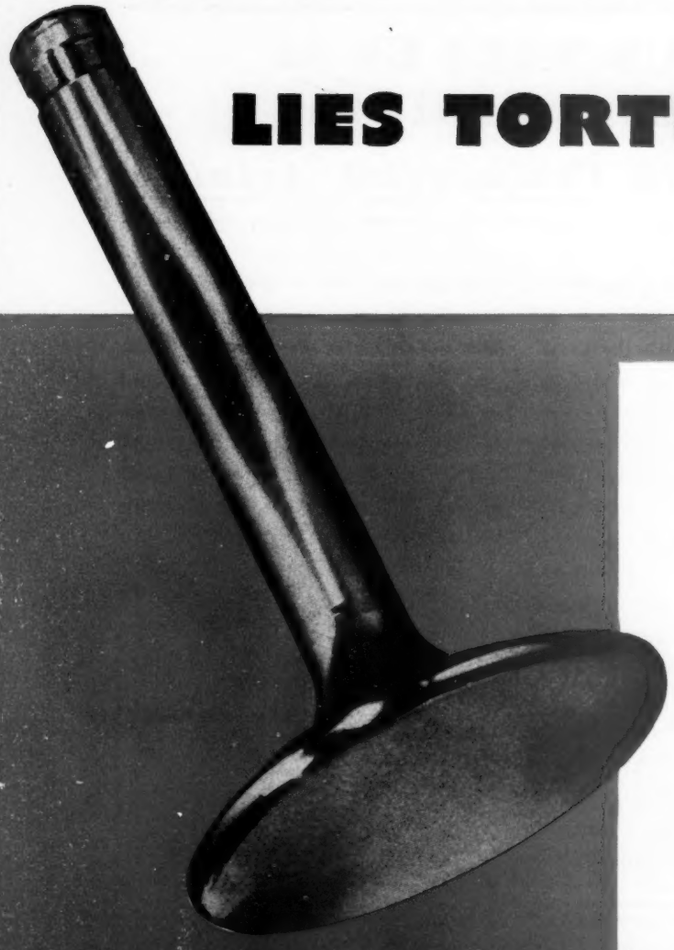
Address.....

City.....

State.....

PARKS AIR COLLEGE East St. Louis, Illinois

BEHIND THESE WALLS LIES TORTURE *and Safety!*



THE SODIUM-COOLED AIRCRAFT VALVE
Pioneered and developed by
Eaton's Wilcox-Rich Division.

THIS is the Engineering Research Laboratory of Eaton's Wilcox-Rich division. It is the largest and most completely equipped laboratory in the world devoted to the study of valves, valve train design, materials and performance.

Behind its walls, inquisitive and persistent

engineers, never willing to "let well enough alone," literally "torture" materials and finished products. Stresses, strains, heat, wear—everything a valve must cope with in actual service is intensified and carefully analyzed.

The result is greater safety, longer service, finer, more trustworthy performance in day-to-day flying, because of greater precision in manufacture—finer quality in materials—and uniformity in the finished product.

Eaton engineering and research have conclusively proved their value in the development and continued improvement of the Rich Sodium-Cooled Valve and other Eaton Aircraft engine parts during more than twenty years' close association with the aircraft industry.

EATON

EATON MANUFACTURING COMPANY

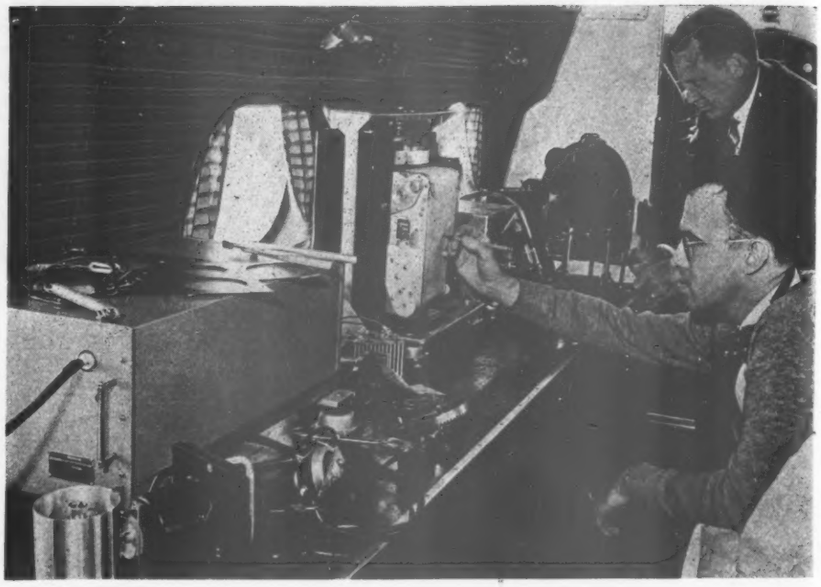
General Offices: Cleveland, Ohio

Plants: CLEVELAND • DETROIT • SAGINAW • MARSHALL • BATTLE CREEK • JACKSON • VASSAR • MASSILLON

time they become a member of United's staff. Then to make certain that they continue to be at least as healthy as when they started, periodic examinations are given to every person. The thoroughness of the examination varies according to the type of work that the person is doing. The most difficult is the examination given to the pilots.

How exacting and painstaking the airlines are in conducting medical examinations of pilots is exemplified in the new twelve-room laboratory and clinic. Medical equipment alone cost $15,000. At least once a year each pilot of the United system is routed into Chicago for personal examination by Colonel Tuttle and this super-overhaul is given in addition to the regular examination taken locally. Such an examination takes more than two hours to complete and fills out a 12-page work sheet on which there are 94 general and specific points plus sub-headings. The eyes seem to take it on the nose during this exam where, for example, there are 23 distinct steps and 63 different tests given to insure optic efficiency. A pilot can't even keep what he eats a secret for this reveals what types of vitamins he is feeding to his system. For instance, an insufficiency of Vitamin A affects the vision and makes for "night blindness." To test this the pilot is instructed to stare at a special light for three minutes which bleaches the "visual purple" from his eyes. This exhaustion of visual purple is what happens to automobile drivers at night when they are blinded by glare from the lights of approaching cars. After the visual purple is bleached, all lights except a small one of very low luminosity are extinguished. The pilot then sits in the dark and watches for a small dim light to return, and he is required to distinguish the axis at which it is set. A stopwatch is used to determine if he can correctly identify the position of the test object in no more than three minutes. If he fails to do this, his diet is changed and he increases the content of Vitamin A.

In the cold chamber new equipment is tested at low temperatures encountered at high altitudes.



Inside the Flying laboratory seats along one side have been removed and a bench installed for test apparatus. Here new radio equipment is put through a flying test for all weather conditions. Results have proven of tremendous value in the design of new equipment and redesigning of old. The cockpit instruments have been left unchanged.

The medical department has compiled complete records of all discomforts occurring aloft for the full calendar years of 1938 and 1939 and is right up to date on similar statistics for the calendar year 1940. The results of this study have shown that out of every 100 passengers flown, only one became uncomfortable or, to put it another way, 99 out of every 100 passengers transported enjoyed their trip in perfect comfort.

Research for Future Air Travel

The study by this department is not limited to present-day flying, however, as a great deal of research is at present being conducted on what problems may arise in air travel of the future. What effects high altitude flying will have on passengers has been one of the major projects under investigation. Appropriate oxygen equipment has been installed in all of the present planes that have been designed so that any passenger may use it who wishes to. Experiments conducted by this department oftentimes take them to the high altitude and cold chambers. This equipment has no end of uses and from it have come some extremely valuable information and data on what may affect people under varying conditions.

The most important piece of laboratory equipment that the research department has is the "flying guinea pig." On the basis of United's safety policy that no new development should be installed in regular planes until it has been thoroughly flight tested, the company revamped one of its Boeing 247-D transports and turned it over to the airline's communications laboratory to be used exclusively as a research plane.

The plane has the official title "365" and is known throughout the air line by its distinctive coloring. During 1939, over 40 different projects were tested aboard the laboratory, including such valuable pieces of equipment as the terrain clearance indicator, instrument landing system, portions of ventilating equipment, fuel and vacuum pumps and paint for exterior decoration. Summed up by the officials of the airlines, plane 365 accomplishes two purposes for United: (1) it enables United engineers in the various fields of the company's operations to test experimental projects in actual flight and thus to improve and accelerate technical developments, and (2) it enables United Airlines to give a thorough proving of development of refinement of every project in exhaustive flight study before installation is made on standard type transports.

Thus with the newest acquisition to United's research department the flying laboratory might well symbolize the thoroughness and forward thinking of the staff of United Airlines in carrying out it's program of safe, comfortable and efficient air transportation.

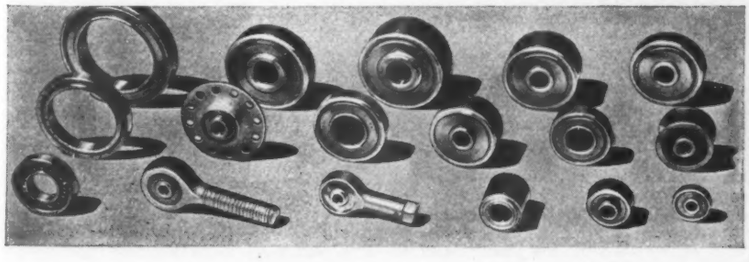
CURE "TRIMMING TAB TETANUS"

Lockjaw of the trimming and balance tabs makes any pilot froth at the mouth; on the other hand, the linkage system can't be too loose. Because looseness means flutter — and flutter has sent many a good tail group earthward, "gone with the wind." Tighten? Loosen? What's the answer?

WHILE THE SHIP IS ON THE DRAWING BOARDS!

The answer is given in the blue print above – showing Fafnir installation in the Curtiss-Wright 20. Letter "Fafnir" at the points of linkage – right on the sketch. And it's a logical answer, too, for trimming and balance tabs are supposed to make flying easier. And you can't make flying easier with a gadget that only Goliath could adjust.

It costs only a little more to make flying easy and safe with Fafnirs at *every* link in your control system – the bearings that are "test-hopped before flight" by over a hundred minute Fafnir inspections which *prove* them right. Letter "Fafnir" at the right spots on your sketches, right now, for the quality that you and all other aircraft manufacturers have acknowledged for over ten years. The Fafnir Bearing Co., Aircraft Division, New Britain, Conn.



FAFNIR

Ball Bearings

FOR AIRCRAFT ENGINES AND CONTROLS

Mainliner Maintenance

(*Continued from page 33*)

"Plane Overhaul," is the watchword, and evey mechanic knows what his particular job is to be. Two or three dozen men swarm in and around the plane. There is no confusion, no lost motion, because an unbelievable amount of work is to be done in the two working days before this ship must be ready for the next scheduled run. A score of activities are going on at the same time, each of which is performed by men experienced in that particular job.

Inspectors are the key men. They have had at least nine years of experience, but that is a minimum length of service, and most have been working on airplanes for even longer periods. Three inspectors tackle the ship, dividing the work according to a pre-arranged schedule.

The airplane is raised on power-driven jacks so that the wheels may be removed. The many inspection plates, located at strategic positions throughout the plane, are removed or swung open on their hinges. Through many years of experience the airlines, working closely with the airplane manufacturers, have learned where trouble in the interior of the wings and fuselage might develop. At these points the skin covering is removable. An inspector, armed with a flashlight and what looks like an enlargement of a dentist's mirror, can examine these critical internal points. And they don't miss a thing!

These inspectors are the diagnosticians of their profession. They poke and prod around the airplane the way your physician does around you when you go in for your periodic check-up. They even have a stethoscope to get the feel of the wing ribs where there are no inspection openings. True, it isn't the delicate stethoscope your physician uses on your chest but it works as effectively for its purpose. It is a small suction cup on the end of a handle. As an inspector presses it against the under side of a wing rib, he can tell from the feel and the sound if the rib is in a strong, healthy condition.

A large transport is an extremely complex mechanism. It contains literally miles of electric wiring, control cables, and plumbing that carries gasoline, oil, hot water for heating the cabins, and hydraulic fluids for operating instruments, flaps, landing gear and brakes. There are valves, pumps, switches and controls by the score, to say nothing of the two great engines and all their accessories, which we'll talk about later. At the time of the plane overhaul United's inspectors delve into this elaborate system, scrutinizing operating parts, checking connections and fittings, and testing pumps, valves, switches and all movable parts. Inspectors carry clip boards on which are mounted inspection forms listing parts of the airplane to be covered in the check. Notations are made that direct the mechanics to do specified work. Before a plane is given a final O.K. more than 500 items will have been checked.

Along the line from coast to coast, United mechanics and field men keep the Mainliners moving on schedule.

In the interior of the ship the carpet that runs down the center aisle is removed and the floor boards taken up, permitting an inspector to examine cables and tubing that run through the belly of the airplane. In sleeper planes the movable seats and all curtains come out and are stacked on a rack for a close inspection. Any fabric that is damaged goes to the upholstery shop. The inspector begins at the wash-rooms in the rear and by the time he gets up to the nose, every inch of the interior will have been scrutinized.

Up in the radio compartment, just aft of the pilot's cabin, experts from the radio department are removing equipment which they take to the radio shop for testing. In the cockpit the two pilot's chairs are removed to give more work space. Half the instruments are removed and sent to the instrument shop for testing, and the balance are tested in the airplane. The complicated hydraulic system, the electrical connections and switches, de-icing equipment, cabin heaters and dozens of mechanical gadgets are carefully checked.

While this is going on the engine-change crew has been busy. Working in two groups, one for each engine, they have removed the cowling and sent it off to the cleaning room. Then propellers are taken off, the variety of pipes and electrical connections that nourish the engines are disconnected and by means of an overhead hoist and a monorail the engines are lifted free of the ship and moved off to one side where carburetors, magnetos and other accessories are removed. Engines are then transferred to portable engine stands and towed into the engine shop where they are so completely disassembled their own mother wouldn't know them.

And that brings us to the subject of the special shops—which tend to make United's base unique. There is a variety of special equipment in these shops that exist at no other airline base. The shop divisions are as follows: engines, propellers, accessories, instruments, radio and electrical sheetmetal, machine shop and battery. In each of these shops are specialists in that particular kind of work. In fact, in each shop there are super-specialists who concentrate on one phase of the work.

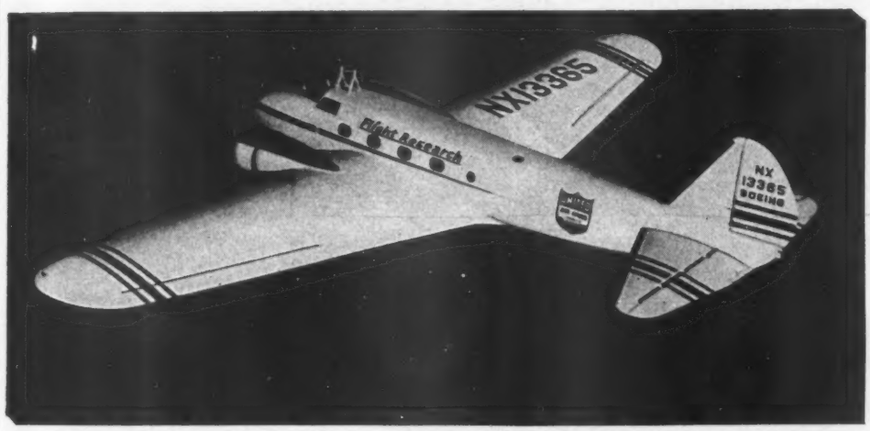
In the engine shops the great Pratt & Whitneys are completely disassembled each 600 hours, even though they have run sweet as a spring song every minute since their last overhaul. Every bolt and nut is removed and the hundreds of parts are piled in neat order on a multi-shelved truck and trundled to the cleaning department where they are scoured and passed on for inspection. Steel parts are then Magnafluxed, which is a magical pro-

BENDIX RADIO

BENDIX AIR RADIO NEWS

PTEMBER 1940 | Published by BENDIX RADIO CORPORATION, Baltimore, Md. | Cable Address BENRAD

UNITED AIR LINES ORDER NEW BENDIX AUTOMATIC COMPASS FOR ALL SHIPS

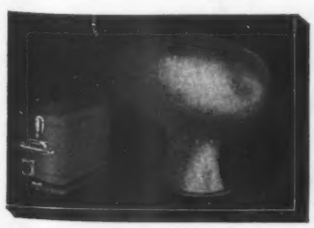


United Air Lines Flying Laboratory. After comprehensive tests, the Bendix MN-31 Automatic Compass and Direction Finder installed on this ship proved its superiority and determined United Airlines' purchase of Bendix Automatic Radio Compasses for every ship in the giant Mainliner Fleet.

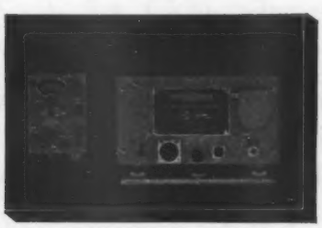
Orders Placed after Extensive Flight Research Proves Reliability of the New Bendix Automatic Radio Compass

Approved the Bendix Automatic Compass. (Left) R. T. Freng, veteran pilot and Director of Flight Operations for United has been a prominent figure in the development of airline navigational technique for many years. He personally assisted in the tests of the Bendix Automatic Compass which were directed by J. R. Cunningham (Center) Director of Communications and executed by P. C. Sandretto, Superintendent of the United Communication Laboratory.

Tests in Scheduled Air Line Service on this Northwest Airlines Passenger Liner covered many months, and more than proved the accuracy and reliability of the new Bendix Automatic Compass.



Control Unit and Loop. The control unit provides the mechanism for automatic loop rotation, including a rate change circuit which reduces the speed of loop rotation as the correct bearing is approached preventing over-shoot. Loop rotating motor and associated mechanism in base which mounts flush with skin of the airplane.



Bendix MN-26 Radio Compass Receiver and Remote Control Unit. Over 2,600 Bendix Radio Compass Receivers are in daily service under all types of flight conditions in civil and military airplanes throughout the world. Single or Dual remote control. Instantaneous Electrical Band Change. Self-contained power supply. Can be switched for use as regular receiver if desired.

Instantaneous Bearings are read from the Bendix Direct Reading Azimuth Indicator, automatically corrected for quadrantal error. Movable scale can be set to plane's magnetic, or true heading. Two indicators can be used simultaneously if desired.

FLASH!!!

National Airlines and Trans-Canada also choose Bendix Automatic Compasses for their new Lodestars!

UNITED *CELEBRATES THE* 20th

At dawn, September 8, 1920, the first coast-to-coast air mail flight took off from Hazelhurst Field, Mineola, Long Island. The small, single-engined plane had few instruments. Its pilot had no communication with the ground. And he flew only during daylight hours. Three days later Flight 1 reached San Francisco.

Twenty years later, to the day—September 8, 1940—United Air Lines' famous "Continental" will take off from La Guardia Field at 5:30 pm, to fly to California *overnight*, following the same route from New York, via Cleveland, Chicago and Omaha to the Pacific.

The big Mainliner sleeper scheduled on coast-to-coast Flight 47,844, will be manned by a crew of two pilots and a stewardess. At their disposal is every modern airplane and airway facility. Passengers aboard will enjoy luxurious accommodations. And the next morning they will step out in San Francisco, at 8:04 am, after a restful night's sleep in a berth as big as a twin bed. Their fare is less than $150—compared with the $400 charged the first trans-continental passengers.

ANNIVERSARY
of the MAIN LINE AIRWAY

Thus, this month, United's Main Line Airway marks its Twentieth Anniversary. Flight 47,844 reflects the result of the great pioneering of the U. S. Post Office Department, followed by the engineering progress achieved during United Air Lines' world record experience of 175,000,000 miles of flying.

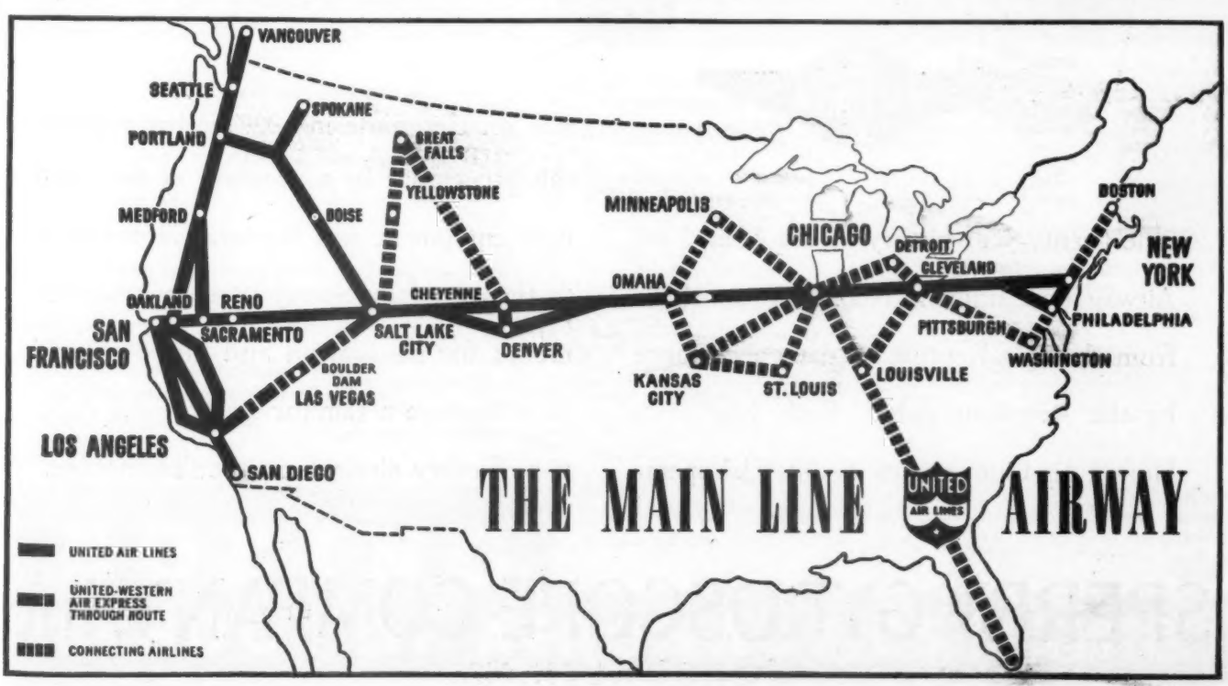
United's Main Line Airway parallels the Old Overland Trail, historic route of the explorers of the West, the covered wagon, the stage coach, the Pony Express, the first trans-continental railroad, telegraph and highway.

On this original cross-continental airway were developed most of the outstanding service features of airline travel, as well as the important scientific achievements that make possible modern airline service.

For twenty years this airway has ranked as the world's busiest long distance air route. Today, great fleets of Mainliners span its length overnight, to provide you swift, dependable, economical air transportation between the most important cities of the East, the Middle West and the entire Pacific Coast.

UNITED AIR LINES

COAST-TO-COAST . . . THE MAIN LINE AIRWAY



The twenty-year history of the Main Line Airway is a brilliant record of transition from daring adventure to daily acceptance by the American public. Each year since United Air Lines started commercial operation on this route in 1927, it has fostered this acceptance by a program of finer and finer equipment and service. Contributing to this program, Sperry gyroscopic instruments for navigation and flight control have become a familiar sight in the cockpits of every airplane on the "Main Line."

SPERRY GYROSCOPE COMPANY, Inc.

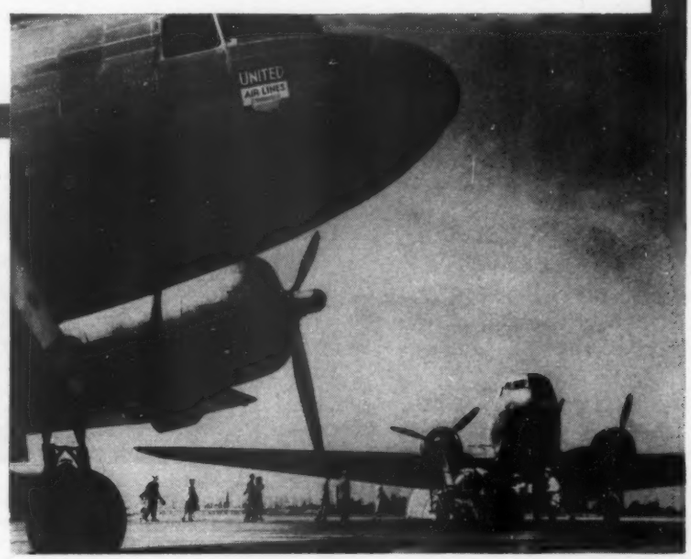
BROOKLYN, N.Y.

R. T. Freng, Director of Flying, United Air Lines, with a 20-year record in Commercial flying, says:

"We will need sixty to eighty co-pilots per year for the next four years..."

"We get our flying personnel from such Government-approved schools as the Boeing School of Aeronautics and from the Army and Navy..."

"In the past year we have hired 20 graduates of Boeing School of Aeronautics as co-pilots—would have hired more, had there been more graduates available..."



THESE straight-from-the-shoulder statements by the Director of Flying for the great United Air Lines point to the growing need for flyers trained in this modern, approved school of aeronautics.

If you want a career (not just a "job") in this growing, modern industry, note these vital facts about Boeing School:

1. **The only school that is owned by a major airline and U. S. Government-approved in flying, mechanics and as a repair station.**
2. **Thirty instructors to guide and inspire you in small classes... for more individual attention.**
3. **Eleven career courses (54 subjects) from which to choose.**
4. **Seventeen modern shops and laboratories.**
5. **Six different heavy, commercial types of training planes.**
6. **Located right on the 890-acre Oakland, Calif., Airport —where you can meet and study the men whom you are training to join.**
7. **All-year flying weather.**
8. **Founded and operated by United Air Lines, the world's most experienced Air Transport organization.**

Full credit is allowed for flight instruction sponsored by the Civil Aeronautics Board.

Boeing School graduates make good. Prepare to join them. Let this be your first step. Fill out and send in the coupon at once.

ENROLLMENT PERIODS: JANUARY, APRIL, JULY, OCTOBER

BOEING SCHOOL OF AERONAUTICS

11 CAREER COURSES One specially designed to fit your chosen field of aviation. Check the course or courses you are most interested in:

Courses requiring High School only
- ☐ Airline Pilot and Engineering
- ☐ Airline Operations and Engineering
- ☐ Airline Mechanic and Operations
- ☐ Aeronautical Engineering
- ☐ Airline Mechanic
- ☐ Aircraft Sheet Metal
- ☐ Private Pilot

Courses requiring 2 yrs. of college
- ☐ Air Transport Engineering
- ☐ Airline Pilot Course

Courses for engineering graduates only
- ☐ Airline Technician ☐ Airline Meteorology

Courses requiring special training
- ☐ Special Airline Pilot ☐ Instrument Rating

NOTE: Link trainer & modern multi-motor instruction available to students in all courses.

Boeing School of Aeronautics
1090, Hangar No. 5, Airport, Oakland, California

GENTLEMEN: Please mail me—without charge—the Boeing School descriptive booklet containing complete information on the school and describing in detail the courses I have checked above.

Name.....

Street Address.....

City.....

State.....*Age*.....

Previous Schooling.....

UNITED AIR LINES

BOEING
SCHOOL OF AERONAUTICS

A DIVISION OF UNITED AIR LINES

cess for discovering flaws that may have developed.

During the magnaflux, parts are magnetized, then immersed in a circulating bath containing metal filings, then examined by microscopes and magnifying glasses. A minute surface crack, or even a flaw beneath the surface, will attract the metal powder in the bath in the form of a black line. A skilled Magnaflux man knows just where to look for possible trouble, and he throws out any part which is not perfect. Only parts which pass this super-critical test are approved for further use. Non-ferrous parts which cannot be magnetized are given careful visual inspection under strong lights.

After its rigid inspection, the engine is laboriously built up again, part by part. When complete it is sent to the engine test room where it is run in for 4 hours, while a careful check is made of its operation. If it meets the high standards set by United Airlines, it is approved and sent through to the engine-change shop in the large hangar, where it will be ready for installation. Even then, it must be test flown before it is finally approved for service.

An example of a specialized shop at Cheyenne is this instrument shop, where all types of aircraft instruments are overhauled, tested, and reassembled before going back into a plane.

In other shops, propellers, carburetors, magnetos, pumps, radios, instruments and batteries are put through grueling tests and completely rebuilt if necessary. In the shops the slogan is, "Test—test—test." Every part that can be tested *is* tested, and usually the tests are more vigorous than under operating conditions on the airplane. All up and down the line, from engineers to mechanics, United's men have shown an amazing ingenuity in designing and building test equipment.

In the accessory shop, for example, there are test benches running around all four sides of the room. After accessories such as carburetors, magnetos and pumps are cleaned, they are connected with test devices that simulate actual operation in the air. The grueling treatment given to spark plugs is typical. Plugs for high-powered aircraft engines are only distant cousins of those used in your automobile. Two conditions are present in an aircraft engine which would literally burn up your automobile spark plugs in a few minutes: great heat and great pressure. So when United's mechanics have taken the plugs apart, cleaned and inspected them, the parts are reassembled, the points are checked for the fine adjustment necessary, and the plug screwed into a test chamber. There the plug is fired under even greater pressure than is exerted in the cylinder. Sensitive instruments record the plug's performance, and a plug that passes the tests will continue to deliver perfect service. A dozen other kinds of accessories ranging from generators to automatic mixture controls are put through their paces. When the dials on the test equipment read O.K., the mechanics don't worry about the part failing in flight.

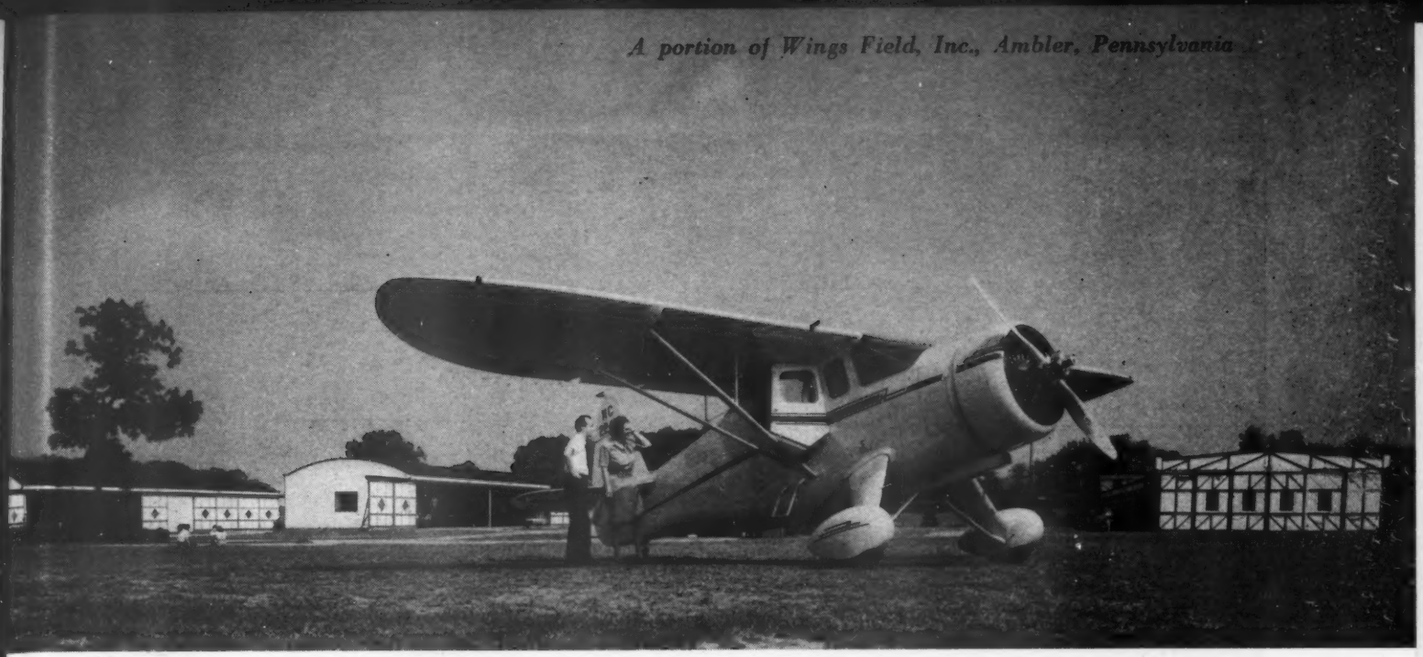
Nearly all of this test equipment, and that in the other shops, was built by United's own machine shop. Not only has the machine shop saved thousands of dollars in the price of new equipment, but a large share of the ouput has been specially designed and could not be bought elsewhere. Equipment built in the machine shop includes an hydraulically operated tool for removing the large tires on a Douglas, a machine for lapping piston rings, a brake drum grinder, several hydraulic test benches, power jacks for raising the DC-3, and many other special tools, jigs and test equipment.

There are 29 men in the machine shop and their facilities include 6 grinders, 8 toolmakers lathes, 2 turret lathes, a shaper, 2 milling machines, 1 two-spindle drill press and tapping machine, 2 large drill presses, a drill grinder, a shaping saw, and there is a new radial drill soon to be received. The shop also has an 18 x 18 x 40 electrically operated heat treating furnace with automatic controls, an electric salt bath drawing tub adjoining it, and a Rockwell hardness tester. A good share of these machines are brand new, and they are not just for show purposes, either. The men can make anything that is on a blueprint, and some that are not.

Down the line from the machine shop is the sheetmetal shop, where an equal amount of valuable work is turned out. The two drop-hammers thump away all day long, welders are busy at both steel and alumium welding, and over in the plating room hundreds of parts are being given special coats to protect them from corrosion. Wing sections and tanks are rebuilt, stainless steel exhaust collector rings and radio racks are made, cabin heating units are fabricated and a variety of parts and fittings are made.

When the Boeing factory discontinued making its famous 247 Model, of which some 50 are now in service, it turned over its jigs and dies to the Cheyenne base of United Air Lines. Now United makes parts for its own 15 Boeings, and for the other 35 that are scattered throughout this country and South America.

In the stockroom at Cheyenne hundreds of different parts are kept which have been bought outside, made in the shops, or overhauled. During plane overhaul as these parts are needed, they are taken from stock and installed in airplanes. An airplane being given the 600-hour check is usually in the hangar for 48 hours, or two working days. The first half-day is spent in removing all equipment which is to go to the shops, removing belly plates and opening inspection plates, making inspections and in getting the exterior cleaning started. Inspections and testing continue in the second work period, and on the next day inspected and approved parts flow back into the airplane. Fresh engines are installed and connected, propellers are put in place, instruments and radio equipment are installed, flooring is put down in the cabin, freshly laundered curtains and chair covers put in place and the entire cabin gone over with a vacuum cleaner, and the many items provided for passengers' comfort are tucked away. In the meantime the cleaners have finished polishing the outside of the ship until it glistens like new silver. Any scratches on the painted insignias are retouched. Windows are cleaned. All items checked



A portion of Wings Field, Inc., Ambler, Pennsylvania

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Experienced airplane owners in these Atlantic Coast states know Inter-City Airlines, Inc., Municipal Airport, Boston, Massachusetts, Seaboard Aircraft Sales on Roosevelt Field, Long Island, New York, Wings Field, Inc., of Ambler, Pennsylvania, and Air Service, Inc., of New Castle, Delaware, as they provide an aircraft service of high calibre.

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No more rubber band models for him! He's graduated to a gasoline motor . . . his first taste of real power.

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For aviation progress depends to a large degree on power. And since increased power must come through refinements in fuels and engines, the engineers of the Ethyl Gasoline Corporation are privileged to work in close cooperation with aviation technicians.

Already this program of continuous research has developed a file of useful data. Much of this information is of practical value today, but there is a great deal more that will be of greatest use in years to come . . . the years when young lads like the one in the picture are ready to take their places in aviation.

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STEEL BENCHES—Provide extra efficiency that means increased production.

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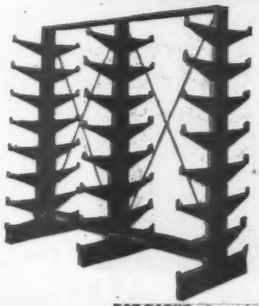

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by the inspectors for repair or replacement have been renewed.

Now comes another round of inspections. Each of the three inspectors gets out his original sheet on which he directed that certain work be done. Then he makes sure the work was actually done. There isn't once in a hundred times that the mechanics slip up, but the inspectors take no chances. When the inspectors say the word, the ship goes out for an hour of test flying with a pilot who is critical of every detail of the airplane's performance. Every instrument, every control is checked and re-checked to make sure it functions properly. Only when the test pilot has added his "O.K." to the long list of approvals is the Mainliner ready for flight.

This 600-hour check is thorough, but it is only part of the maintenance story. At the end of every trip mechanics who have learned their trade at the Cheyenne base go over the plane. They have reports filled out by the captain and the first officer, as well as by the stewardess. Any operating part of the airplane that has been even a hair's breadth out of line is reported and is fixed before the ship goes out on its next run.

As each 600 hours roll around, the airplane is routed back to Cheyenne for fresh engines and all the inspections and testings that make up the plane overhaul. After about seven plane overhauls comes the major overhaul. This occurs at every 5,000 hours and is what the mechanics call "the works". It is hard to imagine an inspection which is more thorough than the plane overhaul described above, but the major overhaul includes all those points and many others.

At the time of the "major" not only are engines, wheels and some of the instruments removed, but entire wings are unbolted. All inspection plates are opened as well as additional skin sections removed along the entire length of the wing. The huge gasoline tanks are taken out and sent to the sheetmetal shop where they are cleaned by steam and tested under pressure. Every rivet in each wing is examined, and if one shows the slightest signs of wear it is replaced. Ribs and spars are thoroughly checked. Not a pulley or fitting is missed. Entire skin sections that may have been dented by stones picked up in take-offs are removed and new ones riveted in place.

All the control surfaces are removed. Ailerons, rudders, elevators, stabilizers and the fin are taken from the airplane. Those with fabric covering have the fabric removed and after inspection and perhaps some new parts, new fabric is sewed in place.

The interior of the fuselage looks as though an orderly tornado had swept through. Every vestige of the comfortable cabin which the passenger sees has disappeared. Seats are removed first, then curtains, lighting fixtures, ventilators, the inside cabin walls, sound proofing, and on and on until only the bare shell of the airplane is left. Wiring, cables, tubing, and all movable parts are ruthlessly taken out.

Up in the pilots' cabin the tornado has continued its way. Not an instrument, switch or control but what has been deftly removed by mechanics and taken back to the shops for cleaning, inspection and testing. While a 600-hour inspection requires two days, the 5,000-hour check takes a larger crew of mechanics four or five days. No thrifty housewife, no hygenic-minded hospital superintendent has ever done such a job of cleaning as these airline mechanics put on. Germs don't bother the boys very much, but the way they look for signs of corrosion, metal fatigue or wear is certainly a caution. Nothing escapes them.

Then the parts come flowing back into the fuselage again and soon a brand new ship is ready for its test flight. It looks as new as it did when it came out of the factory. Actually it is a better airplane than the day it made its first test flight. Like an ocean-going steamship, it has had its shake-down cruise. Old airplanes and engines actually require less maintenance attention than new planes, because any "bugs" have been worked out.

This remarkable maintenance process is not something that occurs spasmodically. It goes on day after day in a never ending process. It is why modern transports do not wear out. The airplanes that were the last word in air transport in 1934 are being superceded by the larger Mainliners for reasons of speed, passenger comfort and operating economy, not because the older ships have worn out. Today's maintenance is so thorough that the great ships flying the main line now will still be operating safely for many years to come. At United it is preventive maintenance that brings perfection.

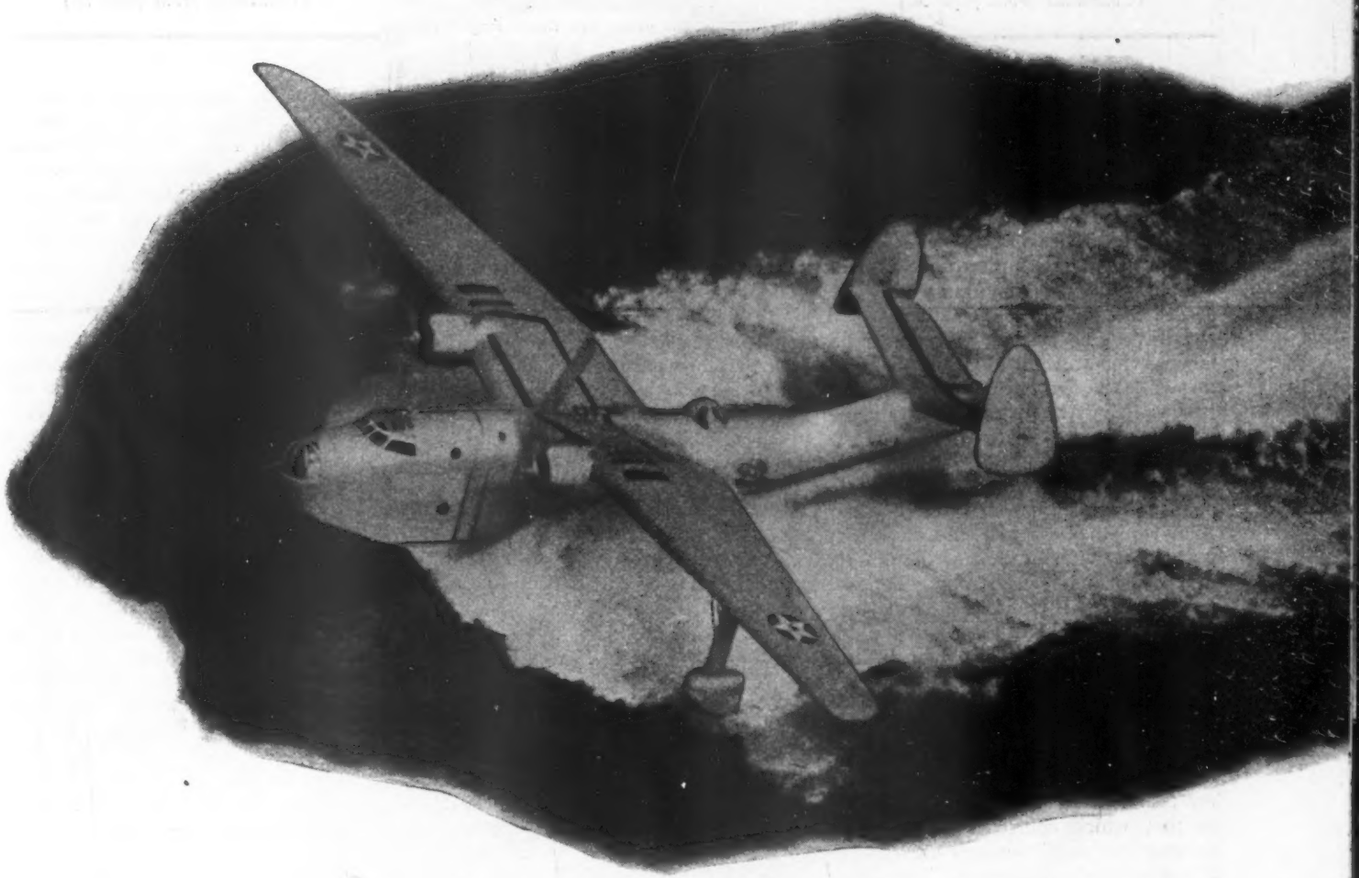
After one has studied the maintenance system that keeps these great transports in the air, he realizes that the true secret of United's success lies in its men. Any business can develop a system, but the degree of its success depends upon the men behind it.

Since its inception, United Air Lines has carried out three steps: chosen its men carefully, trained them well, and encouraged them in their work. Many years ago it organized the Boeing School of Aeronautics. Graduates of this aviation school do not need to work for the airline, but many do. At present, United is using the school to give flight training to all its new co-pilots. In addition, many Boeing graduates who are specialists in mechanical work are employed by United.

A second phase of training is carried out in the Cheyenne shops, where apprentice methods are used to train men for both the overhaul base and for maintenance work along the routes.

Pilots, dispatchers, radio operators, stewardesses — all receive intensive training. And all employees reflect their training in their splendid work.

When a fully loaded Douglas rolls in for a landing a great strain is put upon the landing wheel brakes. United's engineers devised this equipment to grind brake drums on DC-3 transports.



A Battle Cruiser takes off . . .

BY LEE E. FRANK

To the Navy it was a relatively routine matter . . . a patrol plane setting off on a mission under orders.

But to me . . . it was an awe-inspiring sight . . . a powerful battle-cruiser breaking the traditional shackles of Neptune and invading a new medium of flotation in symbol of our country's sovereignty.

The giant flying boat turned . . . its motors thundered their challenge . . . the boat moved faster and faster! Gaining speed it lifted on the water . . . the whirl of foam behind it attained cyclonic proportions . . . on it sped! Suddenly the trail of white ceased . . . it was in the air!

Yes . . . in the air . . . a giant measured in many tons had left the water as smoothly and as effortlessly as if endowed by Nature with the ability to fly. It was a magnificent sight . . . and a reassuring one, too.

For within that hull were means to preserve the liberty, happiness and peace of our country and our people.

Now a speck in the sky above the horizon, the plane is on its mission . . . filling the gaps between our Naval sea forces in their defense of our far-flung neutral zones. An eagle eye of the Navy . . . with the Eagle's striking power against air and surface craft ready when the occasion demands.

In 16 hours it may be back . . . having covered in its course several thousand miles. Or it may not be back for a week or a month. It may settle in a tropical harbor . . . or under some rocky northern cliffs for the night . . . to be on its way again in the morning. It may contact some distant Naval unit . . . may operate with it for days or weeks. But regardless of its mission . . . it will accomplish it with dispatch and efficiency.

It is literally a battle-cruiser of the air . . . with complete accommodations for its crew . . . capable of operating over tremendous ranges . . . from shore or ship bases. A sailor interrupted me . . . "It's one of those new Martin PBM-1's . . . off on a run" . . . I thrilled to the occasion.

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TRADE MARK

Mechanics' Training

(*Continued from page 36*)

lions of dollars was not, of itself, going to save us. They knew that we needed more than the thousands of new planes which an alarmed public demanded, and more than the thousands of military pilots which were to be trained. In order to translate our money into flying equipment, and in order to keep that equipment flying, they knew that we needed thousands of expert aircraft and aircraft engine mechanics in our military services. And to fill this need they turned to the private aviation schools, just as they have turned to private flying schools for primary training of our new crop of military pilots.

There is a lesson for the American public in this action on the part of our Army authorities, and the lesson is particularly vital in view of the present urgent demand for a stronger national defense. This is that it is obvious there are some things which a government cannot do for itself; some jobs which even the Army must turn over to private initiative. In spite of the huge investment which our country has made in educational facilities, it is apparent that these facilities are not geared to the task of meeting such an emergency as that which confronts us. This is because our public schools are essentially academic in character. They teach theory, rather than practice. They train people for living, but not for earning a living; they teach them how to enjoy life but not how to defend it. This is not meant as a criticism of instruction in the fine arts. It is necessary, in some walks of life, to study dead languages, abstruse mathematics, psychology, logic, and the works of Aristotle, Homer, and Chaucer. But right now it is more important that a great many young men learn something about the work of Douglas, Martin, Northrop, etc., than that "all Gaul is divided in three parts".

The curriculum of Curtiss-Wright Technical Institute is based on the needs of the American aviation industry. Since those needs are changing regularly and rapidly as new methods of design and manufacture develop, we change our curriculum without notice as necessary to keep abreast of industry techniques. This is done by constant consultation with aviation industry officials on the part of our staff. Furthermore, our instructors are all drawn from the industry. In addition to their educational background and other teaching qualifications, we require that all our instructors must have had a reasonable period of experience in the aviation industry doing the job that they are required to teach in our school. We have found that men are more important than bricks and masonry, that ideas are more important than text-books.

We teach our trainees to learn by doing. Theory is taught of course, but it is kept subordinate to practice. We stress the provision of actual equipment, engines, parts, tools, etc., that the mechanic will be working with after his employment in the industry begins. So successful has this type of instruction proved that our civilian enrollment continuously sets new records.

In August, 1939, we had 650 civilian students of all classes. In April, 1940, our enrollment had grown to more than 1,000 students, and today we have more than 1,200 civilian students alone under instruction. About 60 percent of these men are taking the master mechanics course and about 40 percent are studying aeronautical engineering. Our paid staff of instructors and employees has now reached a total of more than 150 persons, and our total floor space exceeds 150,000 sq.ft. By any comparison standards this would make a pretty good sized aircraft factory.

Our curriculum has been stripped of all non-essentials in order to produce the maximum result in a minimum time. As a result we are able to train aeronautical engineers in 50 working weeks, master aviation mechanics in 48 weeks, and engine or airplane specialists in 32 weeks. Only the most careful organization, supervision, and coordination, perfected by long experience, makes it possible to give adequate training in so short a time.

It is impressive evidence of how well our system of instruction is organized that we were able to undertake the Army Air Corps mechanic training program on only 45 days notice. During the past year we have trained more than 400 Army men, and our new contract calls for the instruction of more than 1,000 military mechanics during the next twelve months. Our total enrollment is now approaching the 2,000 mark. Yet these hundreds of civilian and military students work side by side in perfect harmony and with remarkable efficiency.

The civil instruction is different in many ways due to the fact that civilian mechanics must have a general knowledge of the whole broad field of aviation, while the military mechanic's training is confined strictly to military types of equipment. For this reason it is possible to train the Army mechanic in 960 hours, whereas the civilian master mechanic course requires 1,920 hours.

In aviation work there is no longer any doubt that sound, basic training pays big dividends.

Siam

(*Continued from page 58*)

mental planes. Local designers and constructors have been trying out indigenous timber in some of their experiments.

Turning to Siam's commercial aeronautics, we find its significance growing yearly not only so far as local air transport is concerned, but also in respect to international traffic. For example, Imperial Airways (British), Air-France (French) and K.L.M. (Dutch) operate a total of six through services each way weekly. Besides, Imperial Airways operates twice a week in each direction between Bangkok and Hong Kong, while Air-France supplements its main-line service to Hanoi with a weekly service between Bangkok and Saigon.

Within the kingdom most of the air transport is operated by the Aerial Transport Company of Thailand which carries air mail to the remote provinces. Any destination within Siam is covered by air mail at least twice a week.

During a typical year ending March 31, 1939, the company's craft transported 16,193,000 kilograms (39,543,-306 lbs.) of mail, 1,784 kgs. (4,357 lbs.) of freight, and traversed 153,542 kilometers (95,351 miles). Passengers are carried only when the amount of cargo permits it.

During the typical year of 1938 there was not a single accident with a loss of life or injury or serious damage to any domestic or foreign aircraft on Thailand's airways. The Aerial Transport Company had scheduled a total of 208 north- and south-bound flights, all completed without a single forced landing or the slightest damage to equipment. In all, 1,321 flights were recorded that year.

All these commercial aviation activities are supervised by the Civil Aviation Division of the Ministry of Economic Affairs. However, the law regulating aerial navigation is administered by the Ministry of Defense.

The Civil Aviation Division is carrying out a long-range program of modern aviation development. Its aids to efficient navigation include numerous airdromes, marine airports and emergency landing fields along all airways. The regular airdromes are provided with concrete runways, fireproof hangars, elaborate terminal buildings.

A network of six aircraft radio stations, all with D/F apparatus and functioning on both standard and short wave frequencies, covers the little nation. Equally up to the minute are the equipment and services of the meteorological division.

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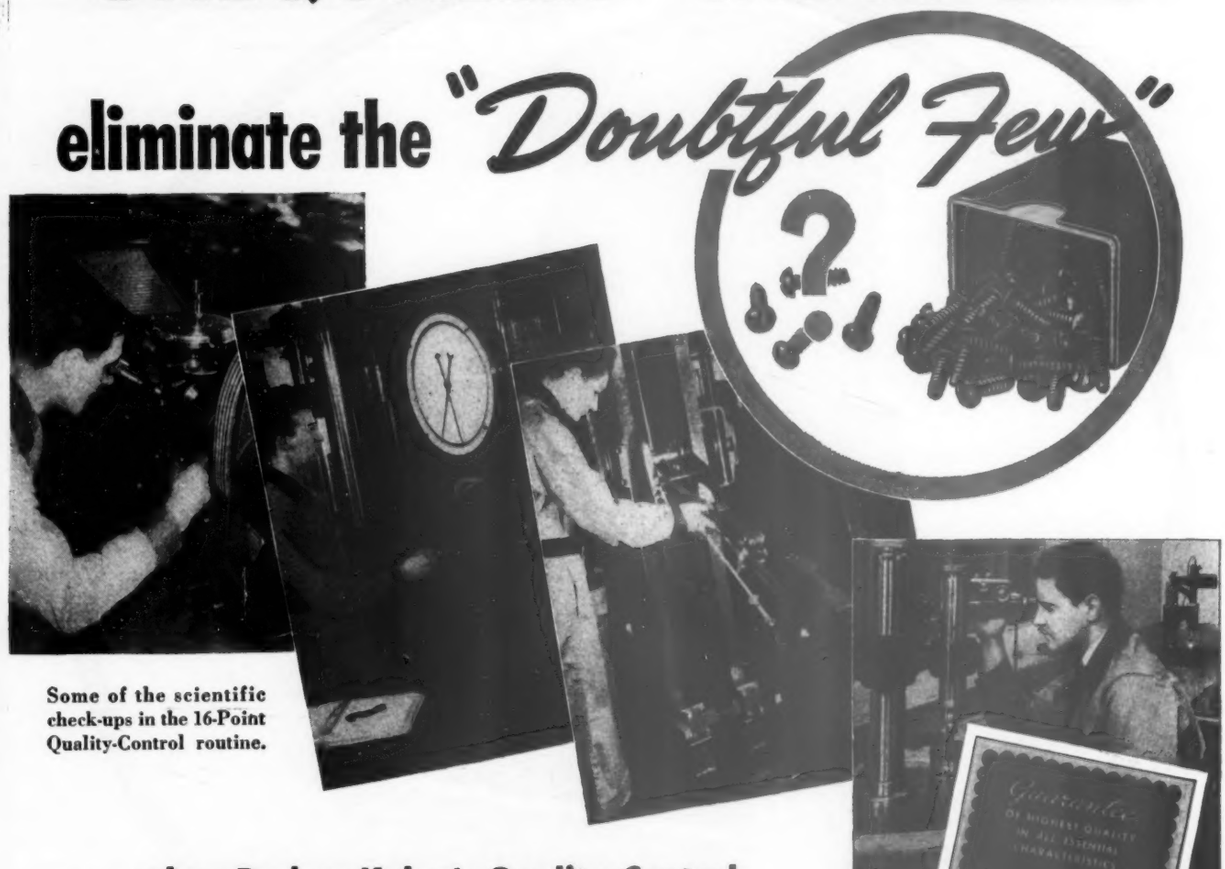

Some of the scientific check-ups in the 16-Point Quality-Control routine.

. . . when Parker-Kalon's Quality-Control Laboratory backs your fastening devices

You get an unequalled protection against time-wasting, cost-boosting "duds" among your fastening devices when you specify Parker-Kalon! For, in Parker-Kalon's plant, an unusual Quality-Control Laboratory stands guard over all production, to eliminate the "doubtful few" screws that slow-up assembly work and produce unsatisfactory fastenings.

Without counterpart in the industry, this scientific Laboratory sets standards of quality that could never be maintained without rigid quality-control of every production step from chemical analysis of the metal to micrometric check-up of finished dimensions. It insures that every Parker-Kalon Fastening Device is more than "good enough" in both accuracy and strength.

Take no chances in your assembly jobs . . . buy Hardened Self-tapping Screws, Socket Screws or other fastening devices that are made in the screw industry's most modern plant. Parker-Kalon Corporation, 190-196 Varick Street, New York.

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Guarantee with every box of . . . .
Hardened Self-tapping Screws
Types, sizes, head-styles for every assembly of metal or plastics
Cold-forged Socket Screws
Cap Screws, Set Screws, Stripper Bolts made to a new high standard of quality
Wing Nuts-Cap Nuts-Thumb Screws
Cold-forged . . Neater, Stronger

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

Quality-Controlled **PARKER-KALON Fastening Devices**

Profitless Prosperity

(Continued from page 57)

regular service last July, should permit TWA to show the greatest improvement in this ratio for the second half.

The increase in passenger revenues closely follows that of revenue-passenger-miles flown. The mail revenue improvement is at a rate which may indicate that a sense of stability from this source of airline income is being attained. Wide fluctuations in mail revenues may occur should there be any major adjustments in the rate of compensation to be paid the airlines or through any revision of the airmail postage rates to be paid by the public.

It is apparent that mail revenues are gradually becoming less important to the air transport industry. Nevertheless, this compensation continues to represent a necessary source of income. Without such revenues, the airlines would all report substantial losses. Mail pay provides that margin which permits the industry to carry through to net the increased revenues resulting from mounting passenger traffic.

Express revenue, percentagewise, appears to be in the ascendency. In dollars and cents, however, this revenue continues to be inconsequential to the industry. For example, gross revenues from all sources, for the six airlines aggregated $26,640,331 for the first half of this year. Of this total, only about $850,000 or 3.2 percent was contributed by air express.

Yet, this piddling amount of express revenue belies the interest currently being shown in this source of income by many interested parties. Practically every major airline has established an air freight or cargo department to examine ways and means to promote greater utilization of air express.

The possibilities present in air freight have also attracted other groups outside of the aviation industry. It is reported that a railroad car leasing organization has advanced a proposal that would incorporate a nationwide system of handling air cargo for the airlines. A different group, with an idea very much in the embryo stage, is also eager to show the air transport industry how to develop the latent earning power which is present in air freight.

Total aeronautic exports to all countries during the first six months of 1940, totaled $138,388,046, representing a 182 percent increase for the like period in 1939 and 17 percent increase for all of last year.

Pitcairn Whirl Wing

(Continued from page 47)

the kinetic energy which had been stored in the overspeeded rotor is then converted into lift. This is the principle on which the jump take-off works.

The general arrangement of the power and control units within the Whirl Wing is shown in the profile drawing. The engine, a Warner Super-Scarab of 175 hp. is separated from the cabin by an insulated metal bulkhead. The nose of the ship contains the transmission and power is delivered from the engine to this transmission unit by means of a drive shaft contained in a housing between the two seats. The shaft to which the propeller is attached extends from the front of the transmission and the small rotor-starting drive shaft extends from the upper-rear of the unit.

The operating controls in the Whirl Wing are dual and have been designed and arranged to provide the utmost simplicity and ease of operation for the pilot. The characteristic Cierva system of direct-control of tilting the rotor axis is employed to provide longitudinal and lateral control. For longitudinal control, the conventional automobile type wheel is moved forward or backward on its sliding column. For lateral control the wheel is turned to right and left. Foot pedals are connected to a vertical rudder on the tail structure for directional flight control.

In previous direct-control autogyros of larger size, certain difficulties were encountered at times because of the tendency of rough air and other rotor disturbances to be transmitted down to the controls. In this new ship, however, the new rotor hub has been designed to eliminate these faults. As in previous autogiros each rotor blade is attached to the hub through two hinges, namely, a flapping hinge which permits a limited up and down movement of the blade, and a drag hinge which allows limited angular movement in the plane of rotation. The flapping hinges are at a 60 deg. (instead of a 90 deg.) angle to the rotor blade axes.

Culver Cadet

(Continued from page 55)

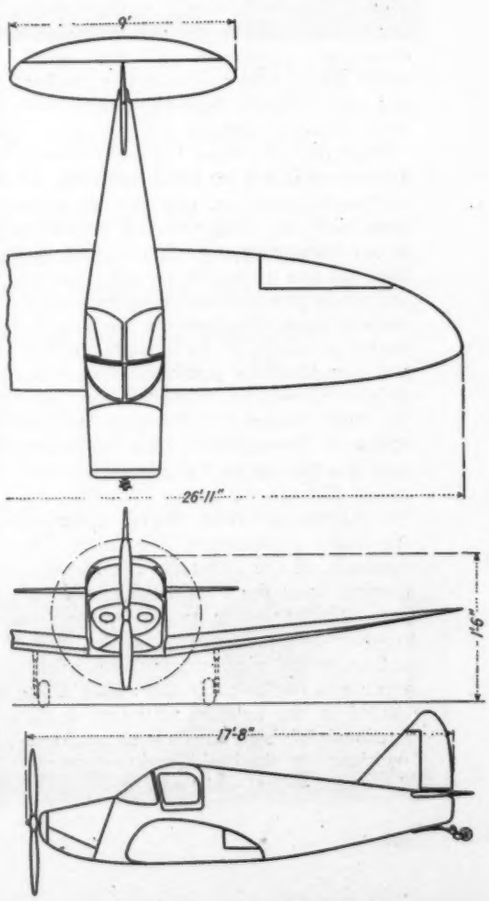
Equipment for the landing gear includes 5.00-4 wheels with expander tube hydraulic brakes, Culver or Hayes wheels and Oleo shock struts. The tail wheel is full swiveling, and is equipped with a spring for shock absorption.

On leading edge of the Culver Cadet, near wing tips, are fixed slots.

Standard equipment includes an upholstered cabin, a baggage compartment after the seats and large enough to accommodate 50 lb. (maximum) of luggage and the following instruments: air speed indicator, altimeter, compass, tachometer, oil pressure and oil temperature gages.

SPECIFICATIONS

Wing span	26 ft. 11 in.	8.1 m.
Overall length	17 ft. 8 in.	5.3 m.
Overall height	5 ft. 6 in.	1.6 m.
Wing area	120 sq. ft.	11.1 sq. m.
Aileron area	9.2 sq. ft.	.8 sq. m.
Fin area	3.77 sq. ft.	.4 sq. m.
Rudder area	3.57 sq. ft.	.3 sq. m.
Stabilizer area	12.4 sq. ft.	.1 sq. m.
Elevator area	5.26 sq. ft.	.5 sq. m.
Power loading	17.4 lbs./hp.	7.9 kg./hp.
Wing loading	10.88 lb./sq. ft.	42.2 kg./sq. m.
Empty weight	720 lb.	327 kg.
Useful load	585 lb.	265 kg.
Gross weight	1305 lb.	592 kg.
Max. speed	145 mph.	225 kph.
Cruising speed	120 mph.	193 kph.
Stalling speed	45 mph.	72.4 kph.
Rate of climb	800 ft./min.	243.8 m./min.
Service ceiling	17,500 ft.	5335 m.
Cruising range	600 mi.	965 km.
List Price	2,395.00 F.A.F.	Port Columbus, O.



Research for Defense

(*Continued from page 39*)

one of degree of intensity rather than any shift in direction. This is as true for research as it is for industry generally. It is now plain that all such efforts have been bent chiefly toward the development of materials and machines for the fighting forces rather than the creation of higher standards of living for the people.

Whether we like it or not, our research must shift its point of view to meet this situation. Where we have been accustomed to thinking in terms of bettering our products for general improvement in our standards of living, we must now begin to gear our efforts toward efficiency for war, for destructive rather than for constructive effort. Our laboratories must begin to concentrate on better optical glass for bombsights and for range-finders rather than on better glass for better houses and safer glass for safer automobiles. For the time being our chemists may have to forget about cheaper and better dyestuffs for gayer and more substantial fabrics for the world of fashion, and put most of their effort on more efficient fuels for fighting aircraft, or more efficient lethal gases. Our aerodynamicists and our airplane designers must put on the shelves their new designs for swifter, safer, and more comfortable airliners for our domestic and over-ocean commerce and must bend every effort toward producing swifter and more deadly fighters, larger and more efficient bombers.

Now that the issue has been clearly defined, what are we doing about it?

True to tradition, although we have been slow to recognize the existence of our emergency, now that we face the issue we are preparing to make use of our whole physical and moral resources without stint. Recognizing the vast research potential of the country, unified and correlated for purposes of national defense, President Roosevelt, on June 15, 1940, created the National Defense Research Committee. This committee acts directly under the council of National Defense,—a group including the Secretaries of War, Navy, Interior, Agriculture, Commerce, and Labor. The functions of the Research Committee—quoting from the Presidential order of June 27, 1940—are to "correlate and support scientific research on the mechanisms and devices of warfare, except those relating to problems of flight included in the field of activities of the National Advisory Committee for Aeronautics. It shall aid and supplement the experimental and research activities of the War and Navy Departments and may conduct research for the creation and improvement of instrumentalities, methods and materials of warfare."

Here, then, is research in frankly war-like guise—here is the authority for science to begin the unwelcome task of beating its plowshares into a sword.

In the excitement of the moment there is, however, one thing that we must watch carefully. Not all of our plowshares can be dedicated to the forge of Vulcan. We are not yet involved in total war. Our present purpose is only to build up our defenses to keep war away from our shores. For the time being, therefore, only a part of our research capacity should properly be devoted to military purposes. Some of it clearly has no military significance whatever, some has only limited application, and some has immediate use. It is important, however, to evaluate our capacity for research properly to use only what we need for the present limited emergency without losing sight of long-range fundamental problems that will be with us many years after this war is only a matter of history. It is definitely a part of the new Research Committee's responsibility to coordinate and to plan our research effort properly so that research that is essential to our economic and social future is not completely disrupted nor set aside during this essentially military interlude.

(To Be Continued)

Junkers Jumo

(*Continued from page 53*)

Merlin in Great Britain. The Germans claim their engines provide better visibility for single-engined planes and are easier to build and service in the field. It might be well worth while for us to investigate the possibilities of the inverted vee-type of high-powered aircraft engine before committing ourselves to the mass production of vast quantities of high-performance liquid-cooled engines of a type which has been discarded in Germany.

Specifications

Junkers Jumo 211 aircraft engine
Type: twelve cylinders, water-cooled, 60° inverted vee, geared drive, four cycle
Bore and stroke: 5.90x6.50 in.
Displacement: 2,136 cu.in.
Length and area: 69 in. x 6.9 sq.ft.
Rated output: 1,200 hp. at 6,500 ft.
1,000 hp. at 16,400 ft.
1,200 hp. for take-off
Total weight (dry): 1,290 lb.
Fuel consumption. 0.45 lb./hp./hr.
Oil consumption: 0.020 lb./hp./hr.
Compression ratio: 6.5: 1

German Warplanes

(*Continued from page 45*)

to be beaten in the following month by a Messerschmidt Me 109 with a speed of 468.9 m.p.h. which is the present high-speed record. The latest Messerschmidt product is the twin-engined Me 110 two-seater fighter which has a speed of 380 m.p.h. at high altitudes and sufficient flight range to convoying.

A visit to the Dornier factories at Friedrichshafen on the shores of Lake Constance proved particularly interesting as both flying boats and land planes were being turned out in appreciable quantities. The flying boats were sturdy Do 24 three-engined patrol planes having a speed of 200 m.p.h. and a flight range of 2,200 miles. Unlike the hundreds of Consolidated PBY twin-engined patrol planes built for the United States Navy, these German planes are equipped with rotatable tail gun turrets and do not have any blind spot astern. Their safety factor in the event of failure of one engine is 66 2/3 percent compared with only 50 percent for our twin-engined flying boats.

Landplane production at the Dornier factories was found to be confined to Do 17 and Do 215 twin-engined bombers having a speed in excess of 300 m.p.h. and a ceiling of 30,000 ft. Some of them were powered with B.M.W. 132 air-cooled radials and others with Mercedes-Benz DB 601 engines.

Practically all the observation planes used by the German Air Force are built by Henschel which incidently is the largest locomotive firm in Europe. In appearance the Henschel He 126 is similar to the high-wing Douglas observation plane used in the United States. The German planes are powered with B.M.W. 132 air-cooled radials and have a maximum speed of 225 m.p.h.

Junkers have the unique distinction of building gasoline and diesel engines as well as warplanes in a dozen or more large factories. The warplanes in production consist of the Ju 87 dive-bomber (Stuka), the Ju 88 twin-engined high-speed bomber, the Ju 89 four-engined heavy bomber and the Ju 53 three-engined transport plane. In addition, numerous Ju 86-K twin-engined long-range bombers powered with diesels have been produced for the Air Force. The writer spent several days at the Junkers factories to see how warplanes and their engines are produced by the largest aircraft firm in the world.

Part II of this article describing the Junkers aircraft factories will appear in an early issue of AVIATION.

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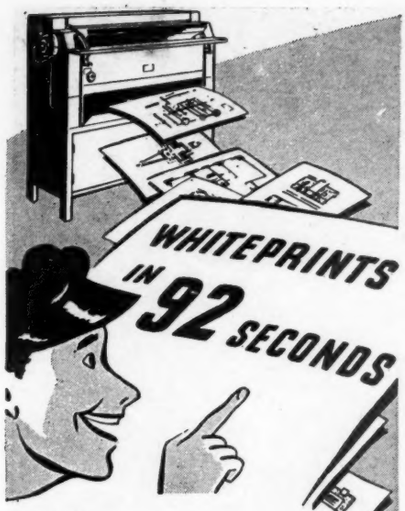

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Pitcairn Whirl Wing

(Continued from page 131)

This provides an automatic aerodynamic cushioning or "feathering" of the blades in flight. The axes of the flapping hinges are located close to the vertical rotor axis and, also, the center about which the rotor-controlled movements take place is practically *in* the plane of the rotor. Consequently, the control loads, against which the pilot must work, are pleasingly light under all flight conditions.

As a safety factor to protect against any accidental disturbing forces from the rotor being carried down to the controls, automotive type cam-and-lever units are attached to the pylon structure just below the rotor hub and the control wires operate these units, which, in turn, carry the control motions to the rotor through rods and arms.

The routine of take-off, flight and landing in the Whirl Wing Autogyro is quite simple. Prior to taking off, the pilot sets a single control handle which does several things, namely, locks the wheel brakes, sets the rotor blades at zero pitch, puts the transmission at a 2 to 1 gear ratio and engages the clutch to the rotor power drive shaft. The pilot then slowly opens the throttle until the rotor speed is brought up to about 300 r.p.m. When this speed is attained, the pilot turns the single control handle, and the ship rises vertically into climbing flight.

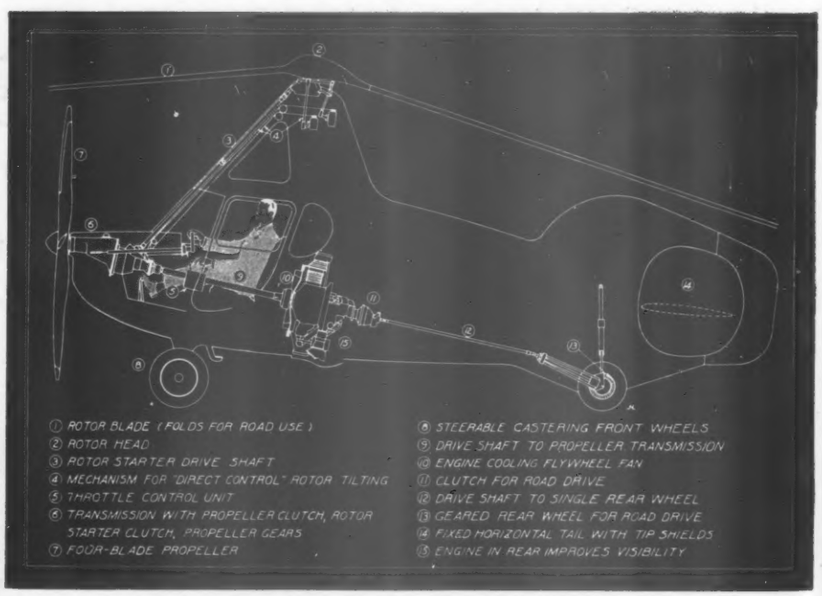
The turning of the control handle in making the jump take-off causes a number of things to take place simultaneously. The rotor blades change from zero pitch to normal flight pitch, the rotor power drive shaft is declutched, the gear to the propeller is changed from 2 to 1 ratio into 1.54 to 1 ratio and the wheel brakes are unlocked. The change of the propeller gear ratio is essential to provide high static thrust and rapid acceleration to flight speed which is attained before the kinetic energy stored in the rotor has been dissipated.

In flight, this ship shows considerable improvement over previous autogiro performance. It is highly maneuverable and can be flown with a minimum of effort. Speeds ranging from 120 m.p.h. to a hovering flight are at the command of the pilot. A slow, vertical descent ending in ground contact with a forward roll of but a few feet is normal under still-air conditions. In a light wind landings can be made with no forward roll whatsoever.

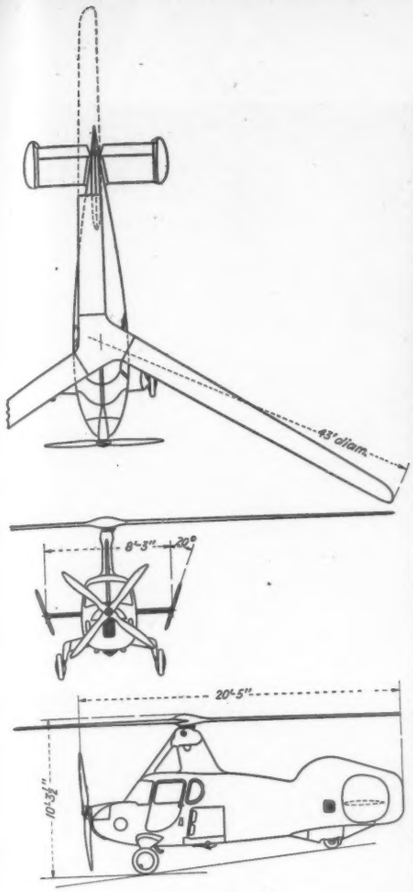
At the pilot's discretion, a descent for landing may be quickly halted by opening the throttle before the wheels touch the ground; which brings the ship back into a climbing flight.

The roadability feature of the Whirl Wing was first developed in 1935–36 for the Department of Commerce Autogyro. The details of the roadability units have been greatly improved in this new ship. With the rotor blades folded back along the top of the fuselage, it can be driven to and from hangar or garage in much the same manner as a motor car.

The cabin appointments, instruments and controls in this ship have been designed and arranged with the simplicity of modern automotive practice. Stew-


① ROTOR BLADE (FOLDS FOR ROAD USE)
② ROTOR HEAD
③ ROTOR STARTER DRIVE SHAFT
④ MECHANISM FOR "DIRECT CONTROL" ROTOR TILTING
⑤ THROTTLE CONTROL UNIT
⑥ TRANSMISSION WITH PROPELLER CLUTCH, ROTOR STARTER CLUTCH, PROPELLER GEARS
⑦ FOUR-BLADE PROPELLER
⑧ STEERABLE CASTERING FRONT WHEELS
⑨ DRIVE SHAFT TO PROPELLER TRANSMISSION
⑩ ENGINE COOLING FLYWHEEL FAN
⑪ CLUTCH FOR ROAD DRIVE
⑫ DRIVE SHAFT TO SINGLE REAR WHEEL
⑬ GEARED REAR WHEEL FOR ROAD DRIVE
⑭ FIXED HORIZONTAL TAIL WITH TIP SHIELDS
⑮ ENGINE IN REAR IMPROVES VISIBILITY

Profile view showing engine arrangement in the whirl wing.



art Warner instrument panel, Ross Automotive steering units, Electric Autolite ignition and similar standard components have been adapted for use in the Whirl Wing. Modern all-metal fuselage and tail construction provide protective strength and simplify maintenance.

The commercial uses for jump take-off autogyros are practically limitless. The design and seating arrangement of the Whirl Wing make this ship well suited for private flying and commuting service. It can also be used for aerial surveying, photography and observation work over city, farm and forest. Passengers can be ferried to and from inaccessible places and restricted areas and this ship offers excellent advertising and publicity value for business and industry.

The application of this type of ship to military needs presents wide possibilities. Fire-control work, reconnaissance, observation and transportation of personnel are but a few of the obvious uses to which it may be put.

Specifications for the ship are as follows:

Disk area of rotor blades	1452.2 sq. ft.
Effective area of rotor blades (3@26.8)	80.4 "
Area of stabilizer	12.4 "
Area of trim flaps	5.4 "
Area of fins [9.1+(2×7.65)]	24.4 "
Area of rudder	5.2 "
Power plant	Warner Super Scarab sek-165 ° F165 HP
Size of wheels and tires	20×4
Shock struts	(R107–2073 C, Bendix type EA-4
Rotor hub	Model H-801
Rotor blade	Model AB-39
Size of tail wheel	12×4
Tail wheel shock strut (R107–277C)	Bendix type AA-3

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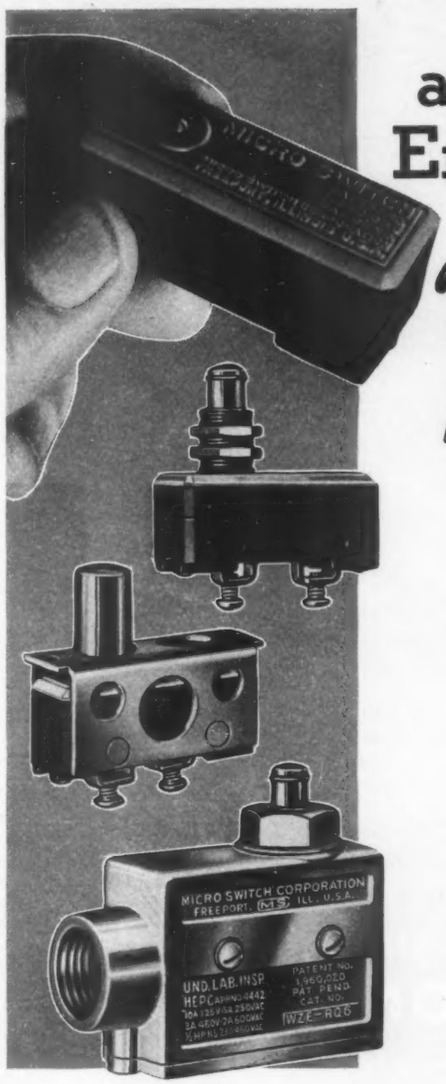

TOP: *Basic Micro Switch, actual size: 11/16" x 23/32" x 1 15/16". Weight .8 ounces.*

SECOND FROM TOP: *Micro Switch with spring plunger for panel mounting. Weight: 1.4 ounces.*

THIRD FROM TOP: *Micro Switch (Army Air Corps Specifications No. 32249) with large cylindrical push button type plunger with metal mounting cover and heavy terminals. Weight: 2.2 ounces.*

BOTTOM: *Aluminum Die Cast enclosed Micro Switch. Light weight for aircraft use. Weight: 4.6 ounces.*

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